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A REVIEW OF THE COTTIDÆ OR SCULPINS FOUND IN THE WATERS OF JAPAN.

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BY

DAVID STARR JORDAN

AND

EDWIN CHAPIN STARKS,

Of the Leland Stanford Junior University.

From the Proceedings of the United States National Museum, Vol. XXVII, pages 231-335.

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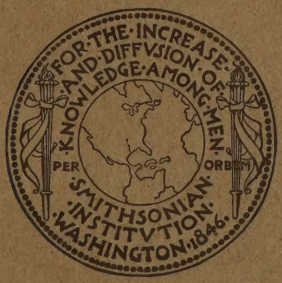

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A REVIEW OF THE COTTIDÆ OR SCULPINS FOUND IN THE WATERS OF JAPAN.

By David Starr Jordan and Edwin Chapin Starks,
Of the Leland Stanford Junior University.

In the present paper is given a review of the genera and species of fishes of the family of Cottidæ, known in English as Sculpins, in Japanese as Kajika or Bero, found in the waters of Japan. The paper is based on the collections made in 1900 by Professors Jordan and Snyder and those made in the same year by the U. S. Fish Commission steamer *Albatross*. Series of the species mentioned are deposited in the United States National Museum and in the collections of Leland Stanford Junior University. The accompanying illustrations are the work of Mrs. Chloe Lesley Starks, Capt. Charles Bradley Hudson, Mr. Kako Morita, Mr. Sekko Shimada, and Mr. Robert Logan Hudson.

Family COTTIDÆ.

THE SCULPINS.

Body moderately elongate, fusiform or compressed, tapering backward from the head, which is usually broad and depressed. Eyes placed high, the interocular space usually narrow; a bony stay connecting the suborbital with the preopercle, usually covered by the skin; upper angle of preopercle usually with 1 or more spinous processes, the head sometimes wholly unarmed. Teeth equal, in villiform or cardiform bands on jaws, and often on vomer and palatines; premaxillaries protractile; maxillary without supplemental bone. Gills 3½ or 4, slit behind the last small, often obsolete; gill-rakers short, tubercle-like or obsolete; gill membranes broadly connected, often jointed to the isthmus. Body naked, or variously armed with scales, prickles, or bony plates, but never uniformly scaled; lateral line present, simple, sometimes chain-like. Dorsal fins separate or somewhat connected, the spines, 6 to 18 in number, usually slender, sometimes concealed in the skin, the soft part elongate; caudal fin separate, usually rounded, rarely forked; anal fin similar to the soft dorsal, without spines; pectoral fins large, with broad procurrent bases, the rays mostly simple, the upper sometimes branched; ventrals thoracic, rarely entirely wanting, the rays usually I, 3 to I, 5, their

insertion well forward. Pseudobranchiæ present. Vertebræ numerous, 30 to 50. Scapular arch normal; myodome developed; actinosts large, partly intervening between coracoids; ribs sessile on the vertebræ. Pyloric cæca usually in small number (4 to 8); air bladder commonly wanting. Genera numerous, mostly of the rock pools and shores of northern regions; many species found in fresh waters; some of the salt-water species descending to great depths. Most of the species are of small size and singular aspect, and none is valued as food. The family is an extremely varied one, which can not readily be thrown into subordinate groups. Almost every species has an individuality of its own, and among the marine forms it is necessary to recognize almost as many genera as species. It is impossible to throw these small genera together into large groups. Of the various forms, probably the American genus *Jordania* is nearest the primitive scaly stock, from which such forms as *Zaniolepis* and *Oxylebius* among the *Hexagrammidæ* are also descended. Fresh-water degeneration is exemplified in *Cottus* and *Uranidea* and deep-water degeneration in *Zesticelus*, *Cottunculus*, and *Psychrolutes*.

A. Ventral fins well developed, the rays I, 2 to I, 5.
- *B*. Spinous dorsal evident, not concealed in the flesh nor indistinguishable from soft part; head with spines or tubercles (except in rare cases), its bones not all hidden in lax skin.
  - *C*. Pectoral fins without free rays below, and not coalescent.
    - *D*. Ventral rays not I, 5; usually I, 3, sometimes I, 2 or I, 4.
      - *E*. Spinous dorsal shorter than soft part, of less than 13 spines.
        - *F*. HEMILEPIDOTINÆ. Body definitely more or less scaly above, the scales sometimes arranged in bands or sometimes modified as bony plates, these usually placed along lateral line or at base of dorsal (skin naked in *Artediellus*).
          - *G*. Last gill arch without slit behind it; gill membranes united, free from the isthmus.
            - *H*. Vomer and palatines with teeth; ventral rays I, 2.
              - *I*. Preopercular spine with 1 to 5 enlarged hooks or antler-like processes above, besides the two on its bifid or emarginate tip.
                - *J*. Body with three series of bony plates, those of the upper and lower series strongly keeled ..... *Stlengis*, 1.
                - *JJ*. Body with a single row of rough plates along the side; head with conspicuous pores ..... *Schmidtia*, 2.
              - *II*. Preopercular spine bifid or simple, without hooks or antler-like processes above.
                - *K*. Vent very close behind ventrals; supraoccipital cirrus very high; skin with small, rough plates ..... *Archistes*, 3.
                - *KK*. Vent well behind ventrals; supraorbital cirrus low or wanting.
                - *L*. Upper preopercular spine forked; a simple flap above eye; body covered with rough scales above ..... *Daruma*, 4.
                - *LL*. Upper preopercular spine simple, more or less hooked at tip.
                - *M*. Body covered above with small, rough plates, those on lateral line larger; preopercle with four spines; preopercular spine slightly hooked ..... *Ricuzenius*, 5.
                - *MM*. Body entirely scaleless; preopercular spine strongly hooked ..... *Artediellus*, 6.

LLL. Upper preopercular spine simple or emarginate; back with a series of larger plates along base of dorsal; sides with scattered scales; body slender and elongate..*Icelus*, 7.

HH. Vomer with teeth; palatines with none; sides with a series of bony, keeled plates.

N. Plates on head very small; body rather robust; preopercle with four spines, the uppermost hooked upward.....*Stelgistrum*, 8.

GG. Last gill arch with a distinct slit behind it.

O, Sides of body with oblique, serrated folds; preopercular spines small, simple or bifid; gill membranes free from the isthmus; no palatine teeth.

P. Caudal fin truncate or nearly so.

Q. Back with a series of bony tubercles along base of dorsal; breast naked, with cross folds of skin.....*Triglops*, 9.

PP. Caudal fin emarginate; body very slender; lower rays of pectoral produced; no bony plates along base of dorsal.....*Prionistius*, 10.

OO. Sides of body without oblique, serrated folds; no bony tubercles along dorsal fin; body very robust.

R. Back with one or two bands of large, rough scales; lateral line without bony shields; palatines with teeth; preopercular spine short.

S. Back and sides with two separate bands of coarse, rough scales; ventrals moderate; spinous dorsal notched; gill openings forming a broad fold across isthmus. *Hemilepidotus*, 11.

SS. Body without scales, but with a band of coarse, bony plates along lateral line; gill membranes broadly united to the isthmus.

T. Preopercular spine simple, very strong. *Enophrys*, 12.

TT. Preopercular spine very long, armed above with recurved hooks. *Ceratocottus*, 13.

FF. Body not definitely scaly nor armed with bony plates, the skin smooth or prickly or with scattered warts; no bony armature along lateral line.

U. COTTINÆ. Skin smooth or warty or velvety, not evenly hispid with stiff prickles; head and body more or less depressed.

V. Gill membranes broadly united to the isthmus, not forming a fold across it; fresh-water species with the head feebly armed; palatine teeth present, occasionally few or wanting altogether; no slit behind last gill arch.

W. Pectoral fin with the lower rays simple.

X. Ventral rays I, 4; palatine teeth usually present.

Y. Suborbital stay with a prominent ridge; head with distinct ridges above; skin prickly; preopercular spine strongly hooked.

Trachidermus, 14.

YY. Suborbital stay flat, without ridge; head rounded above.

Cottus, 15.

XX. Ventral rays I, 3; palatines mostly toothless.

Uranidea, 16.

WW. Pectoral fin with the rays all branched; ventral rays I, 4.

Rheopresbe, 17.

VV. Gill membranes free from the isthmus or else forming a broad fold across it.

Z. Palatines without teeth.

a. Vomer with teeth.

b. Dorsal spines simple, not fringed with tentacles; no tentacles on temporal region.

c. Preopercle with three spines only, the uppermost straight, the third turned downward; skeleton well ossified; lateral line developed, with or without concealed plates. Lower jaw included; post temporal with one spine.

Myoxocephalus, 18.

cc. Preopercle with three spines; lower jaw projecting; post temporal with a double spine ..... *Megalocottus*, 19.

ccc. Preopercle with four spines; the lowermost turned downward.

d. Nasal spines strong; bones of head firm; lower jaw included.

e. Upper preopercular spine very long and straight; no slit behind fourth gill ..... *Ainocottus*, 20.

ee. Upper preopercular spines curved.

f. Ventral fins moderate, not reaching vent ..... *Porocottus*, 21.

ff. Ventral fins very long; reaching past front of anal ..... *Argyrocottus*, 22.

dd. Nasal spines obsolete; bones of head soft and spongy; lower jaw projecting; lateral line reduced to scattered pores; vomer with teeth; deep water sculpins, with feeble fins and reduced armature.

g. Uppermost preopercular spine long and sharp; dorsals separated.

Zesticelus, 23.

gg. Uppermost preopercular spine short and concealed in the skin; dorsals continuous ..... *Cottunculus*, 24.

aa. Vomer and palatines toothless; upper preopercular spine stout, armed with antler-like processes; slit behind last gill small or wanting .. *Gymnocanthus*, 25.

bb. Dorsal spines each with a fringe of tentacles; ventral rays I, 3; a pair of multifid flaps behind orbit ..... *Crossias*, 26.

ZZ. Palatines as well as vomer with teeth; gill membranes free from the isthmus; last gill slit small or wanting.

h. Ventral rays I, 3 (allies of *Oligocottus*).
i. Upper preopercular spine long, with antler-like proceeses; no anal papilla, no flap above eye ..... *Cottiusculus*, 27.
hh. Ventral rays I, 2 (allies of *Pseudoblennius*).
j. Preopercle with antler-like hooks or processes above.
k. Preopercular spine rather long and slender, with one or more hooked teeth above; skin naked; no cirrus above eye. *Elaphichthys*, 28.
kk. Preopercular spine short and flat, divided into many points at tip; a simple cirrus above eye ..... *Alcichthys*, 29.
ii. Preopercular spine, simple or forked, without antler-like processes or hooks above.
l. Preopercular spine forked at tip, a pair of simple cirri at the nape ..... *Furcina*, 30.
ll. Preopercular spine simple.
m. Head normally formed.
n. Pectoral fins very large; a small tentacle on each pore of lateral line ..... *Ocynectes*, 31.
nn. Pectoral fins moderate: anal papilla large.
o. Anal papilla cylindrical, trilobate; a tentacle over eye ..... *Pseudoblennius*, 32.
oo. Anal papilla simple; three pairs of multifid flaps above head ..... *Bero*, 33.
mm. Head very slender, depressed, and pointed, pike-like; body compressed, with very slender caudal peduncle; no cirri on head; preopercular spine straight and sharp; skin smooth ..... *Vellitor*, 34.
hhh. Ventral rays I, 4; preopercular spine strongly hooked upward. *Artediellus*, 6.

FF. BLEPSIINÆ. Skin almost everywhere evenly rough with small bluntish prickles; head and body more or less compressed; fins more or less elevated.
p. Gill membranes free from the isthmus.
q. Spinous dorsal not notched; sides without smooth areas ..... *Histiocottus*, 35.
qq. Spinous dorsal deeply notched; sides with definite smooth areas ..... *Blepsias*, 36.
pp. Gill membranes united to isthmus; first dorsal not elevated ..... *Nautiscus*, 37.

EE. HEMITRIPTERINÆ. Spinous dorsal longer than soft part, of 14 to 18 spines; skin rough with prickles and tubercles; teeth on vomer and palatines; gill membranes free from isthmus; no slit behind last gill; head depressed.
q. Spinous dorsal of 16 to 18 spines, deeply notched, the first spines highest. *Hemitripterus*, 38.

BB. PSYCHROLUTINÆ. Spinous dorsal not evident, its slender spines hidden in the skin; head unarmed, covered by lax skin; no slit behind last gill; no teeth on vomer or palatines; ventral rays I, 3; bones of head moderately cavernous ..... *Psychrolutes*, 39.

AA. EREUNIINÆ. Ventral fins wholly wanting; pectoral fins with the four lowermost rays simple and free from the membrane; teeth on vomer and palatines; gill membranes free from the isthmus; skin covered with velvety prickles. *Ereunias*, 40.

1. STLENGIS Jordan and Starks.

Stlengis JORDAN and STARKS, new genus (*osensis*).

Body not compressed. Jaws, vomer, and palatines with villiform teeth. Eyes large, narrowly separated. No slit behind last gill. Gill membranes broadly united, free from the isthmus. Branchiostegals 6. Preopercle with a long slender spine armed above with several antler-like processes, 3 small sharp spines below. Body encased in 3 longitudinal series of bony plates, which are sharply toothed behind; in addition each plate of the upper and lower series is armed with a sharp keel ending in a sharp hooked spine much as in *Agonidæ*. Belly naked. Ventrals with two soft rays.

(στλέγγις, a comb.)

1. STLENGIS OSENSIS Jordan and Starks, new species.

Head $2\frac{3}{4}$ in length without caudal; depth 5; dorsal VII–14; anal 13; eye 3 in head; interorbital width 10; snout 4; maxillary $2\frac{1}{3}$; preopercle

FIG. 1.—STLENGIS OSENSIS.

spine 4; pectoral $1\frac{3}{4}$; ventral $1\frac{5}{6}$; caudal $2\frac{1}{3}$; height of caudal peduncle $5\frac{1}{2}$.

Upper profile of head broadly rounded; the snout not steep. Body elongate, not compressed; tapering to a slender caudal peduncle; mouth rather large; the maxillary reaching to slightly past middle of eye. Lower jaw slightly included. Small villiform teeth on jaws, vomer, and palatines. Eyes large and very narrowly separated; at upper profile of head. Nasal spines sharp. Angle of preopercle with a long slender spine which reaches to edge of opercle, its upper edge armed with 5 antler-like processes. Lower edge of preopercle with 3 small sharp spines; the lowest one pointing forward. No tentacles on top of head.

Body encased in 3 longitudinal series of bony plates, which are sharply toothed behind; each plate of the upper and lower series has an enlarged spine directed backward. The lowest series contains 24 plates and extends from just in front of the anal to the base of the

caudal fin; the middle series contains 28 plates, and begins just behind the parietal region on top of head, bends obliquely down to side of body at tip of pectoral, thence runs straight and ends a distance equal to diameter of eye in front of caudal; the top row contains 26 plates, and runs from under middle of spinous dorsal to caudal fin. Belly naked.

Dorsal separate; tips of last dorsal rays end vertically above those of anal, but not reaching to caudal. Pectoral reaches a little past front of anal. Ventrals with 2 rays each; their tips almost reach to first anal ray. Caudal rounded.

Color faintly brownish above; a slightly dusky band at base of caudal; a black spot on posterior part of spinous dorsal; soft dorsal dusky; other fins colorless.

The type and only specimen was dredged by the U. S. Fish Commission steamer *Albatross* in Suruga Bay at Station 3788, off Ose Point. It is 38 mm. in length, and is numbered 50912, U.S.N.M.

2. SCHMIDTIA Jordan and Starks.

Schmidtia JORDAN and STARKS, new genus (*misakia*).

Body elongate, not compressed; tapering into a slender caudal peduncle. Eyes large, close together. Preopercle armed with 4 spines; the upper one long and slender, and armed above with 5 sharp antler-like processes. Villiform teeth in bands on jaws, vomer, and palatines. Gill membranes broadly united; free from isthmus. No slit behind last gill. Head with many large pores. Dorsals separate, but close together. Ventrals with a concealed spine and 2 soft rays each. Caudal slightly rounded. Sides with a lateral row of wide plates, which are ctenoid on their posterior edges; body otherwise naked.

(Named for Peter Schmidt, of St. Petersburg, in recognition of his studies of Japanese fishes.)

2. SCHMIDTIA MISAKIA Jordan and Starks, new species.

Head $2\frac{5}{6}$ in length without caudal; depth $5\frac{1}{2}$; dorsal IX–16; anal 12; lateral plates 35; eye $3\frac{1}{4}$ in head; interorbital 15; snout $4\frac{5}{6}$; maxillary $2\frac{3}{5}$; fourth dorsal spine 3; longest dorsal rays $2\frac{1}{2}$; longest anal rays $3\frac{1}{2}$; length of pectoral $1\frac{3}{5}$; ventral 2; caudal $1\frac{3}{5}$; height of caudal peduncle 6.

Upper profile of head broadly rounded; the snout moderately steep. Top and sides of head and mandible with many pores. Mouth at extreme lower aspect of head; little oblique; the maxillary reaching to below posterior margin of pupil; anterior end of maxillary on a level or slightly below a level with lower margin of eye. Small villiform teeth in rather narrow bands on jaws, vomer, and palatines. Lower jaw slightly included. Eyes large, at upper profile of head; narrowly separated by a slight, convex, interorbital bone; orbit less

curved at lower edge than at any other point. Nasal spines well developed and sharp. Upper preopercular spine long and slender, its tip reaching to or a little past edge of opercle; armed above with 4 sharp antler-like processes. Lower edge of preopercle with 3 moderately large sharp spines; the upper one the largest; the lowest one hooked forward. Lateral plates rather long and narrow; sharply toothed on posterior edge; the longest ones near middle of body, where they are about equal to height of caudal peduncle; the line of plates beginning on nape at each side of second dorsal spine, running obliquely to sides a little behind tip of pectoral, and thence straight to caudal.

Origin of spinous dorsal anterior to tip of opercle flap a distance equal to half the diameter of eye. Dorsals completely but slightly separated. Tips of last soft dorsal rays each well past those of anal,

FIG. 2.—SCHMIDTIA MISAKIA.

but fail to reach base of caudal by a distance equal to three-fifths diameter of eye. Origin of anal under third ray of soft dorsal. Pectoral with 17 simple rays; its tip reaches to opposite front of anal. Ventral with a concealed spine and 2 soft rays; the inner ray the longer; reaching two-thirds of distance from its base to origin of anal. Caudal slightly rounded.

Color, light uniform brown above, white below; a few roundish diffused spots, irregular in size and position, along sides below lateral plates; a similar spot at base of upper pectoral rays; a dark bar with blended edges runs from middle of eye downward and slightly backward; another runs from anterior end of eye to side of snout; pectoral slightly dusky toward tips of rays; spinous dorsal dusky, sometimes with a dark spot posteriorly; soft dorsal obliquely crossed with light and dark bars; other fins colorless.

Two specimens dredged by the U. S. Fish Commission steamer *Albatross* (Station 3698), in 153 fathoms, in Sagami Bay, off Manazuru Point. They are 68 and 77 mm. in length. The larger one is the type and is numbered 50913 in the United States National Museum; the other is No. 7506, Ichthyological Collection, Stanford University.

3. ARCHISTES Jordan and Gilbert.

Archistes JORDAN and GILBERT, Fish. Bering Sea, in Rept. Fur Seal Invest. for 1896–97, III, 1899, p. 454 (*plumarius*).

Head and body compressed; lateral line armed with a series of spinous plates; a series of smaller similar plates along base of dorsal widening anteriorly so as to fill the space between dorsal and lateral line, but not extending around front of dorsal to connect with band on the other side. Head naked; gill membranes broadly united, free from the isthmus; no slit or pore behind last gill; no spines above eye or on vertex; a single gently curved preopercular spine, not forked and without cusps or processes; a large fringed supraorbital flap; small flaps and cirri on occiput, sides of head, and along lateral line; teeth on jaws, vomer, and palatines; dorsals continuous, notched between spinous and soft portions; ventrals I, 3, without setæ; vent far forward, immediately behind base of ventral fins, the male with a long anal papilla.

(ἄρχος, vent; alluding to its unusual position.)

3. ARCHISTES PLUMARIUS Jordan and Gilbert.

Archistes plumarius JORDAN and GILBERT, Fish. Bering Sea, in Rept. Fur Seal Invest. for 1896–97, III, 1899, p. 454, pl. LIII; Ushishir Island.—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 1901; Ushishir Island.

Head $3\frac{3}{5}$ in length; depth 4; eye $3\frac{1}{2}$ in head. D. X–23; A. 18; P. 15 or 16. Anterior portion of head compressed and narrow, with vertical sides, the width at angle of mouth little greater than diameter of orbit. From the ocular region the head widens rapidly backward and downward to preopercular spine, leaving the occiput narrow; greatest width of head and body near preopercular spine, slightly less than depth of head at occiput; body compressed, everywhere much deeper than wide. Mouth slightly oblique, maxillary reaching slightly beyond vertical from front of pupil, $3\frac{1}{5}$ in head. Jaws and vomer with rather wide bands of uniform fine teeth; a small patch on front of palatines; nasal spines strong, fixed; preopercular spine strong, simple, directed upward and backward, gently curved; preocular margin without further spines or prominences. Opercle thin, without rib or spine; supraocular rim elevated, projecting above profile of head; interorbital space narrow, deeply channeled, the sides sloping convexly; occiput depressed behind the eyes and transversely rounded, rendering the profile somewhat concave; posteriorly the occiput rises and is literally angulated, somewhat quadrate therefore in cross section; vertex without ridges or spines; supraocular flap as long as eye, lanceolate in form, coarsely fringed along the margins; a pair of broad, deeply cleft flaps near middle of occiput, and a second pair at posterior edge of occiput; a long nasal cirrus, a series of short filaments along margin

of preopercle, 1 on suborbital stay, 1 near tip of maxillary, a cleft filament near opercular angle, and a series of 4 filaments along middle of lateral line; anterior nostrils in a short tube; gill membranes widely joined across the throat, entirely free from isthmus. Lateral line rising in a high convex curve anteriorly, the curved and straight portions equal; along its course is a series of 44 plates, with the upper edge free and spinous, large along the curved portion of the line, but diminishing rapidly in size posteriorly, the free edge becoming smooth or nearly so; a series of much smaller but similar plates lies along base of dorsal, extending halfway along back of caudal peduncle, widening under anterior half of spinous dorsal to form a band which nearly fills the space between dorsal and lateral line; skin otherwise entirely naked. Dorsal beginning a pupil's diameter behind occiput. Spines very slender, the anterior ones highest, each crowned with a membranaceous flap which is digitately cleft; the third spine longest, one-half length of head; the last spine about two-fifths the third and one-half

FIG. 3.—ARCHISTES PLUMARIUS.

the succeeding short ray; pectoral rays all simple, the lower thickened with incised membranes, the longest rays reaching vertical from third anal ray; ventrals narrow, reaching front of anal when declined; vent immediately behind ventral fins, the long anal papilla reaching front of anal fin when declined. Color in spirits, light grayish olive, a series of 5 irregular quadrate blotches along the back, usually connected at their lower margins; middle of sides with dusky marblings, from the lower edge of which a series of 7 V-shaped black blotches descend toward lower outline; the dusky marking of sides inclosing small round spots of ground color; an oblique dark bar on snout and a black blotch on lower portions of cheek; interopercle and upper branchiostegals with cross series of black spots; pectoral with a large dark blotch and indistinct cross bars on the rays; anal crossed by oblique dark bars; caudal indistinctly cross-barred; dorsals dusky, without definite pattern; ventrals plain. Length 3 inches. Ushishir Island, of the Kuril Group; only the type known. (Jordan and Gilbert.)

(*plumarius*, feathery.)

4. DARUMA Jordan and Starks.

Daruma Jordan and Starks, new genus (*sagamia*).

Body rather robust, covered above with rough scales, not arranged in definite bands; extending below lateral line posteriorly; no bony plates along base of dorsal; no naked area below dorsal nor in front of dorsal; preopercular spine long, bifurcate; teeth on vomer and palatines; gill membranes broadly united, free from the isthmus; no slit behind last gill.

This genus differs from *Ruscarius*, its nearest relative, in having the ventrals 2-rayed, the scales extending below the lateral line posteriorly, the upper preopercle spine more widely forked, and in having a single flat flap over the posterior part of eye, which is fringed but not divided.

(*Daruma*, a name applied to squat figures of Buddha, and thence to certain thick-headed fishes of Japan.)

4. DARUMA SAGAMIA Jordan and Starks, new species.

Head $2\frac{3}{4}$ in length without caudal; depth $3\frac{3}{4}$; dorsal VIII-12; anal 9; lateral line 30; eye $3\frac{1}{2}$ in head; interorbital 8; snout $3\frac{3}{4}$; maxillary

Fig. 4.—Daruma sagamia.

$2\frac{3}{5}$; length of ventral $1\frac{5}{6}$; pectoral $1\frac{1}{8}$; caudal $1\frac{1}{2}$; height of caudal peduncle $3\frac{1}{2}$.

Body robust, deepest under spinous dorsal. Snout steep. Mouth low. Maxillary reaching to below anterior margin of pupil; its anterior end just below the level of eye. Fine villiform teeth in narrow bands on jaws, vomer, and palatines. Lower jaw included. Eyes large, projecting a little above upper profile of head. Interorbital space very narrow. Nasal spines small but sharp. Upper preopercular spine not reaching to edge of opercle; its tip divided into two spines, the largest hooked upward. On lower edge of preopercle are 3 small rather sharp spines, the lowest pointing forward. Top of

head with a slight ridge running back from each eye, leaving vertex slightly concave. A flat fringed tentacle on superorbital rim above posterior sixth of orbit.

Lateral line armed with plates which are rough on their posterior edge and are but slightly larger than the scales on back. The anterior half of the lateral line bends upward and reaches to just above upper angle of gill opening. Back above lateral line and posterior part of body below lateral line evenly covered with ctenoid scales; these in 32 oblique series; 6 scales between bend of lateral line and back, counting the series running upward and forward.

Pectoral with 15 simple rays, the seventh from the top the longest; reaching to above the base of the fourth or fifth anal ray. The posterior outline of the fin is pointed. Dorsals close together; scarcely attached; first dorsal spine longest, or at least as long as the second and third; slightly shorter than the longest soft rays; $2\frac{3}{5}$ in head. Tips of last dorsal and anal rays ending on the same vertical, but not reaching to base of caudal rays. Caudal somewhat rounded.

Color, light brown on back, white below; a dark band between eyes with sometimes traces of its continuation below eye across cheek; a cross band under front of spinous dorsal; one under anterior third of soft dorsal, one under last dorsal rays, and one across caudal peduncle; spinous dorsal black; other fins colorless, except a dark spot at base of middle pectoral rays and a smaller similar one at base of upper rays; belly and under parts white.

Four specimens collected by the U. S. Fish Commission steamer *Albatross* in 42 to 52 fathoms, in Sagami Bay, stations 3754, 3762, 3763, off Suno Point, Totomi Bay (station 3729, off Omai Point), and from Owari Bay.

The type is from Sagami Bay; it is 32 mm. in length, and is numbered 50914, U.S.N.M. A cotype is No. 7702, Ichthyological Collection, Leland Stanford Junior University.

5. RICUZENIUS Jordan and Starks.

Ricuzenius JORDAN and STARKS, new genus (*pinetorum*).

Head and body slightly compressed; covered with rough scales of moderate size; enlarged plates along lateral line. Eyes large; interorbital space convex. Preopercle with 4 moderate spines; the upper one not enlarged nor with antler-like processes; short and simply hooked upward. Villiform teeth on jaws, vomer, and palatines. Gill membrane broadly united; free from the isthmus. No slit behind last gill. Dorsals close together, but separate. Ventrals with a concealed spine and 2 soft rays each.

(Named for the province of Rikuzen, front-land, on the shores of which region it was taken.)

5. **RICUZENIUS PINETORUM** Jordan and Starks, new species.

Head $2\frac{3}{4}$ in length without caudal; depth $4\frac{1}{5}$; dorsal IX–15; anal 12; lateral line 35; eye 4 in head; interorbital $7\frac{1}{2}$; snout 4; maxillary $2\frac{1}{4}$; fourth dorsal spine $4\frac{1}{6}$; longest dorsal ray $2\frac{1}{3}$; longest anal rays 3; pectoral $1\frac{1}{3}$; ventral I, 2.

Body compressed, the back slightly elevated. Superorbital rim projecting. Mouth large, low; anterior end of maxillary on a level with lower margin of eye; maxillary reaching posteriorly to below posterior margin of pupil. Jaws equal. Small villiform teeth in narrow bands on jaws, vomer, and palatines. Eyes large, separated by a moderately narrow deeply concave interorbital space. Posterior processes of premaxillary strongly projecting. Nasal spines small, but sharp. Edge of preopercle with 4 small sharp spines; the upper one the largest, and slightly hooked upward; the next below directed backward and slightly downward; the two lower ones directed down-

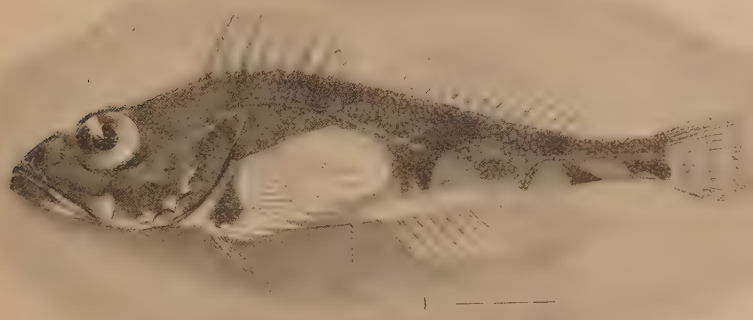

FIG. 5.—RICUZENIUS PINETORUM.

ward. Head and body everywhere covered with rather large rough scales; maxillary scaly. A series of enlarged plates along lateral line.

First dorsal spine opposite upper angle of gill slit; the spinous dorsal rather low; not connected with soft dorsal; the first spine slightly the highest, a little lower than the longest soft rays. Tips of last soft dorsal rays ending on the same vertical with those of anal, but not reaching to caudal. Pectoral reaching a little past front of anal. Ventral 2-rayed; the inner ray the longer; not reaching to vent.[a]

Color, brownish and mottled above, with irregular cross bars; one under middle of spinous dorsal; one under each end of soft dorsal; one across caudal peduncle at base of rays; the anterior ones are the widest and run downward and forward, growing narrower below; a

[a] The caudal of our specimen is broken and can not, therefore, be described.

dark streak from eye across side of snout to tip of chin; a less conspicuous one from eye across cheek; a dark-brown spot on base of pectoral rays; dorsals and pectoral with fine cross lines; ventrals and anal colorless.

The type and only specimen is 55 mm. in length; it was dredged by the U. S. Fish Commission steamer *Albatross* (station 3773) off Kinkwazan Island, in Matsushima Bay; it is numbered 50915, U.S.N.M.

(*pinetorum*, of the pines; Matsushima means pine island.)

6. ARTEDIELLUS Jordan.

Artediellus JORDAN, Cat. Fish. N. A., 1885, p. 110 (*uncinatus*).

Head broad; teeth on vomer and palatines; preopercular spines 2, the upper large, strongly hooked upward, with no antler-like processes above; no slit behind last gill; gill membranes free from isthmus; skin naked, smooth; spinous dorsal short, not notched. Northern seas. This genus seems to be nearest to *Artedius*, from which it differs chiefly in the naked skin of head and body.

(Name: A diminutive of *Artedius*.)

6. ARTEDIELLUS PACIFICUS Gilbert.

Artediellus pacificus GILBERT, Rept. U. S. Fish Comm., 1893 (1896), p. 416; south of Sannak Island, at Albatross Station 3216. (Type in U. S. Nat. Mus.; Coll. Gilbert.)—JORDAN and GILBERT, Rept. U. S. Fur Seal Comm., III, 1898, p. 454; St. Paul Island, Povorotnaya, Kamchatka, Karluk, Robben Island, Bristol Bay, Sannak, Unalaska.

D. VII or VIII–12 or 13; A. 11 or 12; P. 23, 2 (22 to 24); V. I, 3; caudal with 9 divided rays; lateral line 24 (22 to 26); length of head (measured to end of opercular flap) $2\frac{3}{4}$ to $2\frac{9}{10}$; depth $4\frac{1}{6}$; least depth of caudal peduncle $1\frac{3}{4}$ times in orbit; its length, from base of last anal ray, $2\frac{5}{6}$ in head. Very closely related to *Artediellus uncinatus*, differing in the entire obsolescence of the occipital protuberances or ridges in the increased number of cirri on the head, the more numerous pores of the lateral line, the greater number of rays in the pectoral fins, and the reduction in the rays of the caudal. Head evenly rounded in all directions, the orbital region not elevated, the snout not angulated; mouth slightly larger in males than in females, reaching vertical from middle or posterior margin of pupil, $2\frac{1}{2}$ to $2\frac{1}{5}$ in head; lower jaw shorter than the upper, a portion of the premaxillary band of teeth projecting beyond the mandible in closed mouth; teeth cardiform, in rather broad bands on jaws, and in patches of varying size on vomer and palatines; in some specimens a few teeth occur in a single convex series on front of vomer, and but 3 or 4 form a line on palatines; in others, we find an irregular double series or a narrow band on each of these bones; the teeth are always strong and are probably in adult specimens never entirely wanting on either vomer or palatines; longi-

tudinal diameter of orbit 3½ in head; interorbital space very narrow, shallowly concave, entirely occupied by the supraocular canals, which unite in a single pore opposite posterior margin of orbit; least interocular width two-thirds pupil; premaxillary processes projecting but little beyond the profile; nasal spines very small; both pairs of nostrils in short tubes, the posterior situated on anterior orbital rim; occiput with 2 very inconspicuous low-rounded ridges, appreciated with difficulty, and sometimes entirely wanting. No trace of the occipital spine seen in Massachusetts specimens of *Artediellus atlanticus*, nor of the conical protuberances described and figured by Collett in *A. uncinatus* of Europe. Barbels numerous; maxillary barbel large and conspicuous, sometimes simple, more often compound, furnished with from 1 to 4 short lateral branches; a well-developed supraocular cirrus, and a pair of cirri on posterior margin of occiput, the latter occupying the position of occipital spines; a short cirrus near base of opercular flap, and 2 or 3 on preopercle, 2 of which are usually at base of the preopercular spines; 2 cirri on anterior part of trunk, 1 immediately above base of pectorals, the other halfway between lateral line and front of spinuous dorsal; sometimes additional cirri above front of lateral line, and on lower margin of subocular ring; a series of 4 or 5 very short cirri crossing the eye horizontally immediately above the pupil; gill membranes broadly united, joined to the isthmus anteriorily with a wide free margin; gills 3½, no slit or pore behind last arch; preopercular spines as in *Artediellus uncinatus*, the upper one without smaller basal spine. Dorsal fins well separated, low in females, extraordinarily developed in males, the spinous dorsal in the latter well overlapping front of second dorsal and having all of the spines exserted, the median ones for one-half their length; these exserted spines with their free portions narrowly margined with membrane which widens at their tips to form a cutaneous flap; soft dorsal also somewhat elevated in males; ventral fins reaching halfway to vent in females, about three-fourths this distance in males. A series of 5 wide mucous slits running along lower edge of suborbital ring and across cheek; pores of lateral line minute, at the ends of short downwardly directed branches, the main line opening in a large slit-like pore at base of caudal. Color much as in *Artediellus uncinatus*, the lower parts whitish, unmarked, the dorsal region of the trunk crossed by 3 wide dark bars, which often, in adults, break up into spots separated by vermiculations of the lighter ground color, 1 of these bars below the spinous dorsal, running downward and forward to base of pectorals, the second under soft dorsal, the third on caudal peduncle; top and sides of head generally dark, with fine light dots or vermiculations; a light streak sometimes present, extending from preopercular spine forward and inward, meeting its fellow immediately behind eyes; this V-shaped mark usually absent

or inconspicuous, but sometimes, in young specimens, formed of bright silvery-white pigment; other silvery spots or blotches may occur on the lighter intervals of the back or sides; pectorals, dorsal, and caudal cross-banded; a black blotch at base of upper and 1 at base of lower pectoral rays; tips of elongate dorsal spines of the male black; ventrals and anal unmarked. Coast of Alaska, in Bristol Bay, south of Samak Island and north of Unalaska, at depths of from 8 to 61 fathoms. Also at Karluk, off Kamchatka and Robben Island.

This description from Dr. Gilbert's account.

Dr. Schmidt reports this species as occurring in the Japan Sea.

7. ICELUS Krøyer.

Icelus KRØYER, Natur. Tidsskr., I, 1845, p. 253 (*hamatus*).

Head large. Preopercular spines 4, the upper hooked, simple or bifurcate at tip, without antler-like processes. Occiput with or without spines. Body slender, fusiform, with a dorsal series of bony plates from neck to base of caudal; lateral line with osseous tubercles, scattered scales on sides and belly. Gill membranes broadly united, free from the isthmus, no slit behind fourth gill. Dorsals separate; ventrals I, 3, thoracic; no pectoral filaments. Villiform teeth on jaws; vomer, and palatines. Branchiostegals 6. Artic regions.

(*Ἴκελος*, *Icelus*, son of *Hypnus*, the god of sleep; Krøyer says: "Navnet valgt med Hensyn till ulkearternes Dorskhed, saavelsom til den Nordlige Bopæl, nogle af Oldtidens Forfattere anviste Søvnguden.")

7. ICELUS SPINIGER Gilbert.

Icelus spiniger GILBERT, Rept. U. S. Fish Comm., 1893 (1896), p. 412, pl. XXIV; Bristol Bay and Unalaska, at Albatross Stations 3216, 3223, and elsewhere, in 17 to 121 fathoms.—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 1914; same specimens.—SCHMIDT, Faune de la mer du Japon, etc., 1903, p. 15; Japan Sea.

Head $2\frac{4}{5}$ to 3 in length; depth 5; eye 3 to $3\frac{1}{2}$ in head. D. IX–20; A. 17; P. 18; V. I, 3. Closely resembling *Icelus bicornis* of the Atlantic, but differing conspicuously in the armature of the dorsal series of plates in the comparatively plane occiput, and in other characters. Caudal peduncle very slender, its depth $2\frac{1}{2}$ in orbit; mouth large, the maxillary reaching slightly beyond middle of orbit, its length one-half head; teeth very finely villiform, present in rather wide bands in jaws and on vomer and palatine bones; nasal spines strong, separated by the high ascending processes of the premaxillaries; interorbital space very narrow, grooved, its width less than one-half diameter of pupil; orbital rim becoming elevated anteriorly and posteriorly, and, at the latter point, strongly denticulated; behind the orbital region the occiput is shallowly concave, being bounded laterally by 2 low, evenly rounded ridges, which become narrower posteriorly, and end

each in a strong spine projecting backward in line with the series of dorsal prickles; preopercular spines similar to those of *Icelus bicornis*, the uppermost, as in the latter, occasionally simple instead of bifurcate; the second spine usually directed straight backward, and the 2 following downward and forward; gill membranes broadly united, free from the isthmus, and neither pore nor slit behind the innermost gill; branchiostegals 6; eye large, longer than snout; a slender tentacle present over the posterior part of each orbit; a series of plates from nape along each side of dorsals to back of caudal peduncle, and a second series along lateral line; the dorsal series with 28 to 35 plates, each of which bears at its center a single strong spine directed outward and backward. In *Icelus bicornis* each plate is traversed by an oblique ridge, the margin of which is denticulated, the central tooth being the strongest and corresponding to the single spine present in *Icelus spiniger*. The latter agrees with *Icelus canaliculatus* in having an inner series of dorsal plates alternating with the principal series,

FIG. 6.—ICELUS SPINIGER.

each of the smaller plates bearing a minute prickle, discernible with difficulty; the plates along the lateral line, 41 to 44 in number, similar to those in *Icelus bicornis*, having their upper and posterior free margins serrulate. A few scattered spinous plates present in axillary region. Dorsal fins not connected, the spines very slender and rather high; pectorals long, reaching front of anal; ventrals not reaching vent. Color light olivaceous above, white below; upper parts mottled with dark brown; back with 4 faint black crossbars, the first under spinous dorsal, the second and third under soft dorsal, the fourth at base of caudal; a brown blotch on cheek, 1 on base of pectoral, and an irregular series along full length of body just under the lateral line; 2 prominent black blotches on first dorsal; the second dorsal, caudal, and pectoral barred; other fins unmarked; mouth and gill cavity white. Coast of Alaska; numerous specimens from the U. S. Fish Commission steamer *Albatross* stations off Bristol Bay and Unalaska. Recorded by Schmidt from near Vladivostok.

(*spiniger*, bearing spines.)

8. STELGISTRUM Jordan and Gilbert.

Stelgistrum JORDAN and GILBERT, Fish. Bering Sea, in Fur Seal Invest. for 1896–97, III, 1899, p. 456 (*stejnegeri*).

Body formed as in *Hemilepidotus*. Gill membranes widely joined across the throat, wholly free from the isthmus. Teeth on jaws and vomer, none on palatines. No slit or pore behind last gill. Upper preopercular spine simple, gently upcurved, 3 short spines below it. No opercular rib or spine. Nasal spines short and strong. Vertex without spines or ridges and without long tentacles. Spinous dorsal without anterior notch, the vertical fins all few-rayed. A series of plates along lateral line and a band along the back which merges anteriorly into the mass of minute plates covering top and sides of head. Ventrals I, 3, without setæ. Vent immediately before origin of anal.

(στέλγιστρον, scraper.)

8. STELGISTRUM STEJNEGERI Jordan and Gilbert.

Stelgistrum stejnegeri JORDAN and GILBERT, Fish. Bering Sea, in Rept. Fur Seal Invest. for 1896–97, III, 1899, p. 456, pl. LIV; Robben Island (coll. *Albatross*).—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 1921; Robben Island.

Head $2\frac{3}{5}$ in length; depth $3\frac{4}{5}$. D. IX–17; A. 13; P. 16; caudal with 9 divided rays; lateral line with 40 plates; lower series of dorsal band containing 35 to 38 plates. Head narrowly wedge-shaped, tapering upward; width below eyes equaling length of snout and one-half eye; width at preopercles equaling depth at occiput. Mouth large, slightly oblique, the wide maxillary reaching vertical behind pupil, equaling length of snout and eye, $\frac{1}{2}$ length of head. Teeth small, uniform, in narrow bands on jaws and vomer; palatines toothless. A deep naked transverse groove between nasal spines and front of orbits; orbital rims moderately elevated, the interorbital space very narrow, channeled; occiput flat or slightly concave, angulated along lines running backward from orbits, but without spines or ridges; a slender filament above each eye; 2 minute pairs along sides of occiput, 1 on suborbital stay, 1 on maxillary, and a few on plates of lateral line; no nasal cirri, none along edge of preopercle; upper preopercular spine gently curved upward, without cusps or processes; below it 3 short spines, the first directed backward, the second vertically downward, the third, somewhat longer, directed downward and forward. Eyes small, the diameter equaling length of snout, one-fourth length of head measured to end of opercular flap; interorbital width equaling diameter of pupil. Straight portion of lateral line longer than the obliquely placed anterior portion, which is not strongly curved; plates of lateral line strongly spinous on their upper free edges, and of similar and nearly equal size throughout; dorsal band continued on to

back of caudal peduncle, where it is continuous with the band of the opposite side, the lower plates of the band in a definite lengthwise series and as large as those of lateral line or slightly larger, the other plates of the band decreasing rapidly in size toward base of fin, where they are minute. They are partially arranged in series running obliquely upward and backward from the lower larger plates to the bases of the dorsal rays, on which they extend for at least one-half the height of ray. Dorsal spines with minute spinous plates extending almost or quite to their tips. The snout, top of head, nape, suborbital ring, opercles, and cheek above the suborbital stay covered with minute plates similar to the upper part of dorsal band, with which the invested area on top of head is continuous; sides below lateral line naked, except for a few plates behind axil. Dorsals divided to the base, the last spine extremely short, its membrane joining extreme base of the first soft ray; spinous dorsal low, of slender weak spines, the longest ray one-third length of head; longest soft ray $2\frac{1}{4}$ in

Fig. 7.—Stelgistrum stejnegeri.

head; anal beginning under third ray of soft dorsal, ending under its fourteenth ray; caudal peduncle slender, its least width one-third its length; pectorals broad and short, all simple, the lower thickened with moderately incised membranes, the eighth to the tenth rays the longest, extending beyond vertical from origin of anal; ventrals not reaching vent, $2\frac{1}{6}$ in head. Ground color light grayish olive; lower part of sides regularly reticulated with narrow dusky lines; a dusky cross bar from base of posterior dorsal spines and forward to axil; a second much broader bar from front of soft dorsal, ending irregularly below, where it merges into the reticulating lines; a third broad bar, less clearly defined, under posterior portion of soft dorsal; a conspicuous broad V-shaped blotch at base of caudal, the apex directed forward; a faint dark streak from eye forward to tip of mandible, and a cross bar behind eyes, continued faintly on to cheek; spinous dorsal with a small dark spot on anterior and 1 on posterior spines; rays of soft dorsal and caudal with dusky markings so arranged as to form fine

cross bars; terminal half of pectorals finely cross-barred, the proximal half plain, with a large dusky blotch on extreme base; anal very faintly barred; ventrals unmarked. Sea, off Robben Island; one specimen 52 mm. long, dredged in 10 fathoms.—(Jordan and Gilbert.)

A second specimen sent us from Aniva Bay, Sakhalin, was collected by Dr. Peter Schmidt of the Museum of St. Petersburg.

(Named for Dr. Leonhard Stejneger, curator of reptiles and batrâcheans in the U. S. National Museum.)

9. TRIGLOPS Reinhardt.

Triglops Reinhardt, Vid. Selsk. Natur. Math. Afh., V, 1832, p. 52 (*pingeli*).

Body rather elongate, the tail very slender. Head small and compressed. Mouth moderate; villiform teeth on jaws and vomer, none on the palatines; preopercular spines 4, small, simple; head prickly, but without scales; a row of enlarged plate-like scales along the lateral line; a similar row above it at the base of the dorsal fin; the space between these densely prickly; lower half of body crossed at short intervals by transverse undulating folds of skin, the edge of the fold with minute rough scales, causing it to appear sharply and finely serrate, these cross folds being really formed by branches of the lateral line. Gill membranes united, free from the isthmus; a distinct slit behind last gill. Dorsal spines rather high and slender; ventrals I, 3. Arctic seas.

(*trigla*; ὄψ, appearance; the transverse folds resembling the lateral plates of *Trigla*.)

9. TRIGLOPS BEANI Gilbert.

Triglops pingeli Bean, Proc. U. S. Nat. Mus., 1883, p. 355, not of Reinhardt; Plover Bay, Siberia.

Triglops beani Gilbert, Rept. U. S. Fish Comm., 1893 (1896), p. 428, pl. xxviii, fig. 2; Aleutian Islands, Bristol Bay, at *Albatross* stations 3214, 3217, and many others, in 7½ to 42 fathoms.—Jordan and Gilbert, Rept. U. S. Fur Seal Comm., III, 1898, p. 455; St. Paul I., Robben I., Karluk.

Head $3\frac{2}{7}$ to $3\frac{2}{5}$; depth 6; snout longer than eye, $3\frac{1}{5}$ to $3\frac{1}{3}$ in head; eye $3\frac{1}{4}$ to $3\frac{2}{5}$; D. X or XI–23 to 26; A. 24 to 26; C. 12; P. 18; V. I, 3; lateral line 48 to 50; branchiostegals 6. Body heavy at shoulders, tapering rapidly to slender caudal peduncle; depth of caudal peduncle one-fourth its length from base of last dorsal ray; greatest width of head slightly less than its depth, its lower profile straight, the upper descending in a gentle, even curve; mouth nearly horizontal, the maxillary almost reaching vertical from middle of eye, $2\frac{1}{6}$ to $2\frac{1}{4}$ in head; villiform teeth on jaws and vomer, none on palatines; supraorbital rim slightly elevated, a groove-like depression behind it; interorbital space rather wide, forming a shallow groove, its width $3\frac{1}{3}$ to 5 in diameter of orbit; occipital ridges obsolete, a faint trace of them sometimes present, never ending in a spine; opercle with 4 spinous points, the

lowermost directed downward and forward, the others radiating downward and backward. Branchiostegal membranes broadly united, free from the isthmus. Longest dorsal spine $3\frac{1}{3}$ to 4 in head; base of spinous dorsal $1\frac{9}{10}$ to $1\frac{1}{2}$ in head; of soft dorsal $2\frac{2}{3}$ to 3 in length of head and body; length of base of anal $2\frac{9}{10}$ in head and body; caudal slightly emarginate, $2\frac{1}{10}$ in head. Head and upper part of body densely covered with very fine prickles, much finer than in *Triglops scepticus;* lower side of head, the maxillaries, and a narrow strip along the lower side of cheek naked; the usual series of enlarged prickles along the base of dorsals; lateral folds few in number, scarcely exceeding the scutes of the lateral line; they leave a wide, naked strip along the base of anal and do not encircle the caudal peduncle below; breast with 5 or 6 cross folds similar to those on the sides, the scales along margins of folds very small, those of successive folds widely separated, not overlapping as in *Triglops scepticus.* Color light olive brown above, whitish on lower parts of sides and below; the breast and belly, including area in front of pectorals, silvery; back crossed with 4 saddle-shaped black blotches, most distinct in the males; the

FIG. 8.—TRIGLOPS BEANI.

first of these under the middle of the spinous dorsal and extending obliquely forward to the upper axil of pectorals, the second and third under the soft dorsal, narrowing rapidly downward to lateral line, the fourth on the back of caudal peduncle. In males, the lower ends of these cross bars are connected by a narrow lengthwise jet-black streak, extending from shoulder below lateral line nearly to base of caudal, the narrow interval between this streak and lateral line occupied by a bright silvery streak, interrupted by the crossbars; a black blotch at base of upper and one at base of lower caudal rays; a small black spot near tips of the outer caudal rays, the fin otherwise unmarked; an indistinct, dusky blotch below the eye, and a dusky streak along under side of suborbital stay, extending forward along the margin of the preorbital to tip of snout; a blotch on middle of maxillary and upper lip; front of lower lip dusky; a dark blotch on opercle, and a dusky bar on branchiostegal membranes. In the females the general pattern of coloration is the same, but the darker markings are less distinct, and the black lateral streak of the males is represented

by a disconnected series of irregular, dark blotches and vermiculations. In both sexes the dorsals and pectorals are crossed by narrow, dusky bars, formed by series of dark streaks on the rays; mouth whitish, gill cavity silvery white, with the exception of the lining of the opercle and the outer half of branchiostegal membranes, which are dusky. This is the Pacific representative of the Atlantic *Triglops pingeli*, from which it differs in the greater slenderness of the body, particularly of the caudal peduncle, in the somewhat smaller eye, the more pointed snout, the less fine subdivision of the lateral folds, the less complete investment of the fins with prickly scales, and, above all, in the peculiar coloration of the male. (Gilbert.) Alaska to Puget Sound and the Kurils, taken very abundantly by the U. S. Fish Commission steamer *Albatross* at stations located both north and south of the Aleutian Islands and in Bristol Bay; also from about St. Paul Island in 24 to 37 fathoms, off Karluk in 31 fathoms, and off Robben Island in 18 fathoms, and by the present writers in Puget Sound and the Gulf of Georgia, the depths ranging from 10½ to 42 fathoms; specimens 82 to 140 mm. in length also taken in Plover Bay, Siberia.

(Named for Dr. Tarleton Hoffman Bean.)

10. PRIONISTIUS (Bean).

Prionistius BEAN, Proc. U. S. Nat. Mus., 1883, p. 355 (*macellus*).

This genus is nearly related to *Triglops*, from which it differs in the absence of a series of enlarged scutes along each side of base of dorsal fins, in the elongation of the body, in the dorsal and anal fins, and in the emarginate caudal fin. Preopercular spines 4, the lower 3 developed as thin, flat lobes. It agrees with *Triglops* and *Elanura* in all other important structural details, including the exserted, more or less produced lower pectoral rays. Alaska.

(πρίων, saw; ἱστίον, dorsal fin.)

10. PRIONISTIUS JORDANI Schmidt.

Elanura jordani SCHMIDT, MS.; Peter the Great Bay, Vladivostok, Aniva Bay, Sagkalin.

Head 3½ in length to base of caudal; depth 6. Dorsal IX 27; anal 27; lateral plates 49. Eye 3½ in head; snout 3½; interorbital space 7¼; maxillary 2½. Body deepest at base of ventrals, tapering evenly backward to a slender caudal peduncle; very slightly deeper than wide behind base of pectorals and for a short distance behind their tips, as wide as deep posteriorly. Maxillary reaching a very little past anterior border of pupil. Jaws even. Teeth very fine, in narrow bands on jaws, in a narrower band on vomer; none on palatines. Interorbital space slightly concave. Nasal spines very small, but sharp. Edge of preopercle with 3 spines, none of them enlarged; the upper one

inclined a little upward, the next downward and a trifle backward, the next downward and a little forward, the lowest hooked nearly straight forward. Top and sides of head and back above lateral plates with a fine, shagreen-like covering. Maxillaries, mandible, interopercle, branchiostegal region, and a space in front of pectorals, naked. Breast with about 5 rough cross folds. Lateral plates finely toothed posteriorly. Sides below lateral plates with oblique folds, which are roughened on their posterior edges.

Pectoral with 19 rays; the fifth ray from the top the longest; its tip reaches to above the base of the fifth anal ray. Anal beginning and ending a little behind the soft dorsal. The third dorsal spine the longest, equal to the length of snout and half eye. Longest soft dorsal rays a trifle longer than orbit. Dorsals separated by a space equal to a third of eye. Dorsal spine scarcely serrulate. Ventral with a spine

Fig. 9.—Prionistius jordani.

and 3 soft rays; the inner ray the longest, reaching to midway between vent and front of anal. The caudal of our specimen is broken.

Color gray on back, white on lower parts; the indistinct beginnings of 4 or 5 cross bands on back; sides below lateral line, with several irregular, large, dark spots; some indistinct dark bands across upper part of pectoral; ventrals and anal white.

Here described from a cotype, a specimen 70 mm. in length (No. 7704, Leland Stanford Junior University), collected by Peter Schmidt at Vladivostok, and sent by him to the writers, with permission to include the species in the present paper. It was also taken in Aniva Bay, Sagkalin.

This species is between *Elanura forficata* and *Prionistius macellus*, differing from the former in the absence of enlarged tubercles on back at base of dorsal fin, from the latter in having cross folds on breast in front of base of ventrals; the head and body not so rough; no multifid

prickles on head. In a recent letter, Dr. Schmidt refers the species to *Prionistius* and doubts its distinction from *P. macellus*. The latter species is more slender, more rough, and lacks the cross-folds on the breast.

(Named for David Starr Jordan, president of Leland Stanford Junior University.)

11. HEMILEPIDOTUS Cuvier.

Hemilepidotus Cuvier, Règne Anim., 2d ed., II, 1829, p. 165 (*hemilepidotus*).
Temnistia Richardson, Fauna Bor.-Amer., III, 1836, p. 59 (*ventricosus*).

Body with 2 broad bands of rough, scale-like plates on each side, 1 along the side of the back, 1 along the lateral line, the upper bands meeting anteriorly in front of dorsal; scales roundish, their upper and posterior margins free; skin otherwise naked, the naked skin thick and firm; head naked. Villiform teeth on jaws, vomer, and palatines. Top of head rugose, the ridges low, without spines, no spines on supraorbital rim. Branchiostegals 6. A small slit behind fourth gill; gill membranes joined to the isthmus anteriorly but forming a rather broad fold across it; preopercular spines simple, strong. Dorsal fins connected, the first long, with strong spines, emarginate, the first 3 spines shorter than those which follow; ventrals I, 4. North Pacific, in shallow water.

(ἥμι, half; λεπιδωτός, scaled.)

11. HEMILEPIDOTUS GILBERTI Jordan and Starks, new species.

Cottus trachurus Pallas, Zoogr. Rosso-Asiat., III, 1811, p 138 (larger specimen brought from the Kuriles by Joseph Billings, not type, which is spotted underneath, and came from "shores of America").

Head $2\frac{5}{6}$ in length without caudal; depth $3\frac{4}{5}$. Dorsal III, VIII–22 or 23; anal 19. Band of scales on back in 4 transverse series, in 77 longitudinal series. Eye $3\frac{1}{2}$ in head; maxillary $2\frac{1}{3}$; snout 4; interorbital $5\frac{1}{2}$.

Body rapidly tapering and very slender posteriorly. Anterior profile from first dorsal spine to eyes straight; superorbital rim produced; a notch between eyes and produced premaxillary processes; profile in front of nasal spines straight and steep to tip of snout. Mouth rather large, very little oblique, the maxillary reaching to posterior rim of pupil; lower jaw included. Teeth in very wide bands on jaws, palatines, and vomer; wider at front of jaws than at sides; wider on premaxillaries than mandible; about as wide on palatines as on front of mandible. Interorbital rather deeply concave, a pair of parallel ridges at the middle with a channel between them; width of interorbital space, two-thirds of eye. Nasal spines rather long and sharp. Edge of preorbital with 4 spines; the two upper ones the largest, about equal in length; the upper one directed upward and backward; the

next below backward and slightly upward; the next very much smaller, directed backward, a wider space between it and the next than between the others; the next is hooked forward. Opercle with a flat spine at the end of a ridge. Two spines on edge of subopercle, the upper one behind and just above the next to the top preopercular spine; the lower one at union of subopercle with interopercle. A sharp spine on clavicle projecting just below opercular flap; a shorter blunter one on posttemporal just above opercular flap. A long, thin flap on end of maxillary; a short one on upper posterior margin of eye; a very small one at nape.

Distance of first dorsal spine from tip of snout equal to eye and postorbital part of head; the first spine $2\frac{3}{4}$ in head; the third 4; the fourth $2\frac{4}{5}$; the last and next to the last $5\frac{1}{2}$. The soft dorsal higher than the spinous, the third ray $2\frac{1}{6}$ in head; the rays hold their length

FIG. 10.—HEMILEPIDOTUS GILBERTI.

with but little decrease to the sixth from the last where they abruptly and rapidly decrease, the sixth from the last projecting past the tips of the others in the reclined fin. Pectoral reaching to opposite base of second or third anal ray; it has 17 rays, the fifth from the top the longest, $1\frac{1}{3}$ in head. Ventrals nearly reaching vent; the rays I, 4. Anal rays slender, the membrane rather deeply incised; the fourth ray 3 in head. Caudal truncate or slightly rounded, its length $1\frac{3}{5}$ in head.

Color in spirits slightly dusky above, white below, crossed by blackish bars, irregular in shape but the same shape in both of our specimens; head dusky between darker spots; tip of snout dark; a light streak behind, a dark blotch below eye; a dark spot on first 2 dorsal spines, a dark cross-bar under second, third and fourth spines

of second portion of dorsal, running up on fin and spreading out, occupying greater portion of second part of dorsal, below it runs down to behind pectoral base; a spot under front of soft dorsal running down to lateral line where it is widely forked; the forks slender and running to lower part of sides; the next bar under middle of soft dorsal, running up on fin, the next under last part of soft dorsal, widely forked below, the posterior fork running across caudal peduncle and meeting its fellow of the opposite side below; the light interspaces continued on spines to their tips, on soft rays on basal third or fourth; a black bar across base of caudal followed by a wider white bar; a slightly narrower black bar just behind middle of caudal, then a very narrow white bar, then a very narrow dark bar, and the tips of the rays white; anal crossed obliquely by 2 or 3 dusky bars; pectoral dusky; tips of rays lighter and a lighter bar across middle of rays; ventrals white.

The following note was taken from this specimen when it was fresh:

Clear light olive green; mottled with white and dusky, becoming abruptly pinkish white below; bars dusky olive above, dusky red below; greenish below eye; lower side of head pearly; fins all faintly washed with pinkish red; the pectoral pink, whitish and blackish; ventral plain white, very faintly shaded.

The above description is from the type, a female. A cotype, a male, shows the following differences: First dorsal spine $2\frac{1}{5}$ in head; the third $3\frac{1}{10}$; ventrals very long, reaching past tip of pectoral to fifth or sixth anal ray. The interspaces between bars are white and the bars are darker; the head is white except at dark spots as described for the female; the ventrals regularly and conspicuously spotted with black on the rays, each ray with 9 or 10 black spots equal in size to the interspaces; a very few scattered dusky spots on belly; the dusky on pectoral broken up into 4 or 5 inconspicuous bars across rays.

The following note was taken from this specimen when fresh:

Light translucent olive tinged with violet; head tinged with purplish; lips with yellowish; black spot below eye with golden green spots around it; lower side of head pink; bars on side reddish brown; dorsal mottled, orange, black, and whitish; caudal flesh color barred with dark red; pectoral scarlet orange and whitish; ventrals yellow, spotted with black.

This species differs from *Hemilepidotus jordani* chiefly in having a larger eye (which is much longer than snout), a blunter snout, and in being smoother on sides of head and somewhat differently colored.

The type is a female from Hakodate, 235 mm. in length, and is numbered 7446, Ichthyological Collections, Leland Stanford Junior University Museum. A cotype is No. 50916, U.S.N.M. The specimen from the Kuriles, mentioned by Pallas, apparently belongs to this species, which is readily distinguished from the two species found in Bering Sea, *Hemilepidotus hemilepidotus* and *H. jordani*, by the immaculate belly, greater number of dorsal rays, and large eye.

(Named for Charles Henry Gilbert.)

12. ENOPHRYS Swainson.

Enophrys SWAINSON, Class'n Fishes, II, 1839, p. 271 (*claviger*).

Body short and thick, depressed anteriorly. Head very large, mailed above with rugose, bony plates; a series of large, rough, bony plates along lateral line, each with a serrated keel or spine; no scales. Teeth in villiform bands in jaws and on vomer, none on palatines; preopercle with a strong, straight spine which reaches beyond front of dorsal; suborbital stay broad, externally bony; gill membranes joined to the isthmus, not forming a fold across it; a slit behind fourth gill. Dorsal fins separate, the anterior short, not notched; anal short. Intestinal canal elongate. Herbivorous, feeding chiefly on algæ. North Pacific.

(ἐν, on; ὀφρύς, eyebrow.)

12. ENOPHRYS CLAVIGER (Cuvier and Valenciennes).

Cottus claviger CUVIER and VALENCIENNES, Hist. Nat. Poiss., IV, 1829, p. 195; Kamchatka (Coll. M. Collée).—GÜNTHER, Cat., II, 167.

Cottus elegans GRAY, in Cuvier and Valenciennes, Hist. Nat. Poiss., IV, 1829, p. 195; same type.

Enophrys claviger JORDAN and GILBERT, Synopsis, 1883, p. 711.—GILBERT, Rept. U. S. Fish Comm., 1893 (1896), p. 426.—JORDAN and GILBERT, Rep. Fur Seal Comm., III, 1898, p. 458, pl. LV; Robben Island.—JORDAN and EVERMANN, Fish N. and M. Am., II, 1898, p. 1938; Bristol Bay.

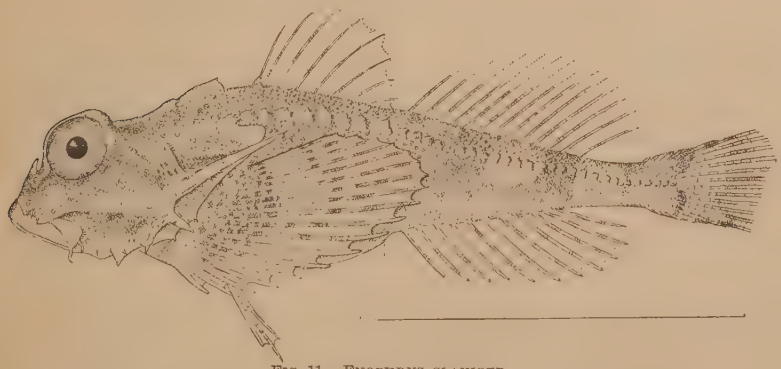

FIG. 11.—ENOPHRYS CLAVIGER.

Head $2\frac{2}{3}$; depth $3\frac{3}{5}$; D. VIII–14; A. 12; P. 16; lateral line with 35 plates. Preorbital with 2 strong spinous projections, which overlap the premaxillary in closed mouth. Interorbital space deeply channeled, the orbital rim raised posteriorly into a blunt spinous tubercle. A small, spinous, occipital tubercle, behind which rises a high, sharp nuchal ridge, which is highest posteriorly and has its upper edge finely toothed. No cirri on top of head. Upper preopercular spine long, simple, reaching beyond head to fourth or fifth plate of lateral line;

below it 3 short, strong spines, the lowermost directed downward and forward; outer surface of the upper spine with 3 or 4 low, finely serrated ridges, its inner edge smooth, without accessory cusps or spinules; opercular ridge high, serrate; 2 sharp spines on anterior angle of subopercle; top and sides of head rough, with minute spinous points; preopercle and lower jaw with numerous short filaments, a longer one on end of maxillary. Body entirely covered with minute prickles, which invest also the abdominal region; those above lateral line longest and most thickly placed; lateral line with a series of plates similar to those in *E. bison*, each surmounted by a sharp spine; lateral line with 2 curves, approaching back most nearly at end of spinous and at end of soft dorsal; many conspicuous white filaments scattered over sides below lateral line. Dorsals entirely separate, the free interspace as wide as pupil. Eye larger than interorbital width $4\frac{3}{4}$ in head. Dusky above, with faint, darker crossbars; light below; 2 black blotches on cheek; some faint dusky V-shaped prolongations of the coloration of the back down toward base of anal fin; fins indistinctly cross-banded; a dark area at base of pectoral, a narrow oblique dusky crossbar on base of caudal fin. Here described from a specimen taken at Robben Island, 151 mm. long. Known also from Bristol Bay, Alaska, and from Kamchatka.

(*clavis*, key; *gero*, I bear.)

13. CERATOCOTTUS Gill.

Ceratocottus GILL, Proc. Ac. Nat. Sci. Phila., 1859, p. 165 (*diceraus*).

This genus is very close to *Enophrys*, from which it differs in having the long preopercular spine armed above with recurved hooks or antler-like processes. Bering Sea.

(κέρος, horn; *Cottus*.)

a. Interorbital width 7 in head, much narrower than distance between parietal ridges; eye $1\frac{3}{5}$ in superior postorbital part of head ..... *diceraus*, 13.

aa. Interorbital width 4 in head, as wide as distance between parietal ridges; eye $1\frac{1}{4}$ in superior postorbital part of head ..... *namiyei*, 14.

13. CERATOCOTTUS DICERAUS (Pallas).

Cottus diceraus PALLAS, Nov. Act. Petropol., 1783, p. 354, pl. x, fig. 7; Petropaulski, Kamchatka (Coll. Steller). — CUVIER and VALENCIENNES, Hist. Nat. Poiss., IV, 1829, p. 189. — GÜNTHER, Cat., II, p. 189.

Ceratocottus diceraus GILL, Proc. Ac. Nat. Sci. Phila., 1859, p. 165; 1861, p. 167. — JORDAN and GILBERT, Rept. U. S. Fur Seal Comm., III, 1898, p. 458, pl. LVI; Robben I., Petropaulsky, Bering I. — JORDAN and EVERMANN, Fish. N. and M. Amer., 1898, p. 1940; Herendeen Bay, Robben Island.

Enophrys diceraus JORDAN and GILBERT, Synopsis, 1883, p. 711. — GILBERT, Rept. U. S. Fish Comm., 1893 (1896), p. 426.

Synanceia cervus TILESIUS, Mém. Ac. Petersb., III, 1811, p. 278, pl. XIII; Petropaulski. (Coll. Steller.)

*Cottus steller*i BLOCH and SCHNEIDER, Syst. Ichth., 1801, p. 63; after Stelle

D. VII–14; A. 10; C. 12; P. 17; V. I, 3. The head large, wider than deep or long; the ridges higher and very rough; orbital ridges elevated, continued backward toward the nape, the occipital ridges sharp behind; upper preopercular spine very long, rough, nearly two-thirds as long as head, reaching middle of spinous dorsal, with 6 or 7 strong recurved hooks or serrations on the upper edge; lower preopercular spines strong; opercle with a longitudinal rib and no distinct spine; lateral line with a row of rough, bony scutella, each with a minute central spine; skin on sides, more or less villous or prickly, with numerous fleshy slips, elsewhere smooth. Isthmus wide; a slit behind last gill; vomer with teeth; anal papilla very large. Bering

FIG. 12.—CERATOCOTTUS DICERAUS.

Sea, rather common from Alaska to Kamchatka and Saghalin. One specimen examined by us from Robben Island. It has been also taken by Dr. Schmidt off Pestschuzoff, coast of Korea.

(δις, two; κεραύς, horned.)

14. CERATOCOTTUS NAMIYEI Jordan and Starks.

Head $2\frac{1}{2}$ in length without caudal; depth $3\frac{3}{4}$; dorsal VII-13; anal 11, eye 5 in head; interorbital 4; maxillary $2\frac{1}{3}$; snout 4.

Profile of head very uneven; the parietal spines are produced, leaving a deep notch between them and first dorsal spine; the profile is thence straight and sloping to the greatly produced superorbital rims; in front of eye is a notch formed by nasal spines and produced premaxillary processes, in front of which snout is steep and straight. Lower jaw projecting; mouth large and little oblique, the maxillary reaching to posterior margin of pupil. Teeth rather coarse, villiform, in broad bands on jaw and vomer, palatines toothless. Interorbital broad and deeply concave; no ridges along its middle; its width a little greater than distance between parietal ridges, nearly equal to post-orbital part of cranium in a median line on top, greater than length of snout measured straight on a median line, and equal to snout measur-

ing the chord of its curve from union of premaxillaries to front of eye. Nasal, preorbital, and suborbitals, rough surface bones; the nasals ending in a prominent, wide, rather sharp spine. Preorbital with 2 blunt spines on its lower edge; suborbital stay expanded on cheek to a wide, long plate, but growing narrow and sharp behind. Preopercle spine long, reaching a little past opercle flap, measured along lower edge from notch with spine below its length is $2\frac{1}{2}$ in head; above it is armed with 6 or 7 prominent irregular spines; preopercle below armed with 3 spines; the lowest slightly the longest, the top one at base of long spine and pointing straight back; the next pointing downward and slightly backward, its position midway between the others, the lowest directed obliquely downward and forward. Opercle with a prominent rough ridge ending behind in a blunt spine; subopercle

FIG. 13.—CERATOCOTTUS NAMIYEI.

with 2 small, sharp, slender spines; the upper one on a level with top of pectoral, directed downward and backward; the lower one directed downward. Superior postorbital part of head anteriorly depressed below surface of interorbital region, leaving a transverse ridge behind eyes; nape similarly depressed, leaving a transverse ridge at occiput; the depressed postorbital area bounded laterally by straight, rough parietal ridges which end behind in rough, blunt, but very prominent spines. Two small tentacles at under part of side of mandible, and a similar one at symphysis; 3 at end of maxillary. A patch of scattered, small, acute spines on the skin under pectoral, and a lateral row of 32 bony plates along side of back.

Pectoral extending to opposite front of anal or a little past; its posterior border very broadly rounded; it has 19 rays, the lower 10 or 11 swollen; its length is contained $1\frac{2}{3}$ in head. The distal fifth of ventrals extends over the median point between their base and front

of anal. Dorsal spines long and slender, the tips of the second and third crooked and extending far beyond membrane and other spines, the third spine reaches base of third dorsal ray when it is reclined. Fourth dorsal ray 2 in head; the fin high and rounded in outline; when reclined it reaches to within fourth-fifths of diameter of eye of the base of upper caudal rays. Anal very high, the sixth to ninth equal in length and equal to postorbital part of head and half eye; the first ray the shortest $2\frac{3}{4}$ in head. Caudal truncate or very slightly rounded. Intromittent organ very large; thick at the base, and as long as the anterior anal rays. Lower part of side above anal with many small filaments scattered over it.

Color, gray on back and head, profusely spotted with dark-brown spots of various sizes, larger anteriorly, becoming smaller and lighter posteriorly; the spots on head below suborbital stay larger and closer than elsewhere; back with 4 regular but not conspicuous crossbars; faint traces of one under last dorsal spines, broad, diffuse, and dusky under pectoral; more conspicuous one near each end of soft dorsal and across base of caudal; the dark color of back changes abruptly to white at middle of sides; entire underparts of body and head white; caudal with 2 broad, black bars containing 3 or 4 irregular white spots across rays; caudal bordered behind with white; the white interspace between bars is narrow, and there is a broader white space near base of rays; soft dorsal crossed with 5 vertical bars obliquely across the rays, the interspaces narrower than the bars, and white; fin bordered behind with white; spinous dorsal black, with 3 or 4 diffused spots; pectoral bordered with white, the basal half of the rays light, spotted and mottled with dusky, the posterior half black with blended white spots and streaks, the short lower swollen rays are white, the membrane between dead black; ventrals dusky; the anal is everywhere profusely spotted with small, light, grayish brown spots, crowded, but separated by fine white lines; the spots are composed of fine dark points; each ray is followed by a row of 7 or 8 more conspicuous spots more broadly outlined with white.

The type is a male from Nemuro in Hokkaido, and is about 245 millimeters in length. The single cotype from Soya, west coast of Hokkaido, is a dried specimen presented by Mr. Motokichi Namiye, then curator in the museum of the Imperial University of Tokyo.

The type is numbered 8107, Ichthyological Collection Leland Stanford Junior University Museum. The cotype is numbered 50917, U.S.N.M.

(Named for Motokichi Namiye.)

14. TRACHIDERMUS Heckel.

Trachidermus HECKEL, Ann. Wiener Mus., II, 1840, p. 159 (*fasciatus*); not *Trachyderma*, the correct orthography, used by Latreille in 1929 for a genus of Coleoptera.

Centridermichthys RICHARDSON, Voyage Sulphur, Fishes, 1846, p. 73 (*ansatus*).

This genus differs from *Cottus* chiefly in having a much depressed head bearing ridges covered by a moderately thick skin; 2 ridges on each side of top of head from behind eye, diverging backward; a ridge on opercle, and a prominent one on suborbital stay; spine at angle of preopercle very much hooked and having the gill membrane more narrowly connected to isthmus. It has teeth on jaws, vomer, and palatines; branchiostegals 6; no slit behind last gill arch; origin of anal behind middle of entire length, and skin usually with prickles; lower pectoral rays simple. Ventral rays I, 4. Mountain streams of southern Japan, China, and the Philippines.

(τραχύς, rough; δέρμα, skin.)

15. TRACHIDERMUS ANSATUS (Richardson.)

YAMA-NO KAMI (MOUNTAIN WITCH); AYUKAKE.

??*Trachidermus fasciatus* HECKEL, Ann. Wiener Mus., II, 1840, p. 160, pl. IX, figs. 1, 2; Philippines.

??*Centridermichthys fasciatus* GÜNTHER, Cat. Fish., II, 1860, p. 170, copied.—ISHIKAWA, Prel. Cat., 1897, p. 48; Kii, Shikoku, Tokushima.

Cottus uncinatus SCHLEGEL, Fauna Japonica, Poiss., 1843, p. 38; "Mers du Japon" probably from Chikugo River, northeast of Nagasaki (not *Cottus uncinatus* of Reinhardt, 1833, a species of *Icelus*.)

Centridermichthys ansatus RICHARDSON, Voyage of Sulphur, Fishes, 1844, p. 74, pl. LIV, figs. 6–10; Woo Sung, mouth of the Yangtze.

Head $2\frac{1}{2}$ to $2\frac{3}{5}$ in length without caudal; depth $5\frac{1}{2}$; dorsal VIII–18 or 19; anal 15 to 18;[a] eye $5\frac{1}{3}$ to $5\frac{1}{2}$ in head; interorbital width $6\frac{1}{2}$ to 7; maxillary $2\frac{1}{6}$.

Head and anterior part of body depressed; the head is nearly twice as wide as deep. Teeth in moderate bands on mandible, vomer, and sides of premaxillary, becoming wide on front of premaxillary; in a narrow line pointed at each end on palatines. Lower jaw included; maxillary reaching to posterior margin of eye. Interorbital rather wide, concave, and without ridges, continuous with a wide concave area on top of head between ridge from eyes, superorbital rim very much widened posteriorly. From each eye a pair of ridges run backward which are covered by moderately thick skin; the inner ridge diverges from the outer one toward its fellow of the opposite side and, in specimens 8 cm. and under in length, ends in a small blunt spine at

[a] Fin formulæ of 32 specimens: 22 specimens have 19 dorsal rays; 10 specimens have 18 dorsal rays; 20 specimens have 17 anal rays; 11 specimens have 18 anal rays; 1 specimen has 15 anal rays.

each side of occiput; in larger ones it becomes lower at the end and is not even angulated; the outer ridge runs along pterotic region and ends without a spine. Opercle with a rather strong ridge, and a strong wide ridge runs along the suborbital stay and ends at the upper preopercle spine. Nasal spines scarcely developed, not projecting through the skin. Preopercle with 4 spines; the upper larger than the others and very strongly hooked; the 2 next below rather blunt and directed downward and backward, the lowest one hooked forward. Body of the smaller specimens closely covered with small rough prickles, the head with a few smooth papillæ; in large specimens the prickles are more scattered and not nearly so rough.

Origin of anal under fifth dorsal ray, or midway between tip of caudal and middle of eye. Pectoral reaches to front of anal; it has 18

FIG. 14.—TRACHIDERMUS ANSATUS.

rays, the lower 10 simple, the upper ones divided once; the fifth ray and 3 below are the longest, $1\frac{1}{2}$ in head. Ventrals with one concealed spine and 4 rays; their tips reach half way from their base to front of anal. Origin of spinous dorsal a little in front of tip of opercular flap, its base $1\frac{1}{5}$ to 2 in head, its longest spines three-fourths of length of longest soft rays; the soft rays behind the third or fourth are subequal in length to within a like number from the posterior end. Caudal somewhat rounded; its length $2\frac{1}{8}$ in head.

Color grayish brown on back, white below, back and sides crossed by 5 slightly oblique crossbars similar in position to those on *Cottus kazika* and *Cottus pollux;* a conspicuous black bar running forward from each eye to tip of snout, involving tip of mandible; another bar running from eye obliquely backward and downward across cheek; a similar bar connecting eyes across interorbital space. Ventrals and anal white; other fins with irregular cross lines, formed by light-brown spots on rays; a dark spot on base of pectoral and first 3 or 4 spines

of dorsal with a large black spot. All of these markings, but especially the crossbars, more conspicuous in the young.

The following color note was taken from a fresh specimen: A vertical bar of deep scarlet with yellow dashes on the skin under preopercle partly covered by that bone, this bar extending on upper branchiostegal rays. Fins and body light and dark olive.

Numerous specimens of this species taken in the Chikugo River at Kurume, the largest 125 mm. in entire length. It is said to be abundant in mountain streams of Kiusiu in company with *Bryttosus kawamebari*. The long description of *Centridermichtys ansatus* by Richardson, from the Yangtze seems to agree closely with our specimens. Its bright scarlet head markings are very conspicuous in life. *Trachidermus fasciatus* Hechel, from the Philippines, seems to be closely related, but is probably not the same fish.

The specimen here figured has a smaller number of anal rays than usual.

(*ansatus*, jug-handled, from the curved, preopercular spine.)

15. COTTUS (Artedi) Linnæus.

Cottus Artedi, Genera Piscium, 1738, p. 49.
Cottus Linnæus, Syst. Nat., X, 1758, p. 264 (*gobio*).
Pegedictis Rafinesque, Ichth. Ohiensis, 1820, p. 85 (*ictalops*).
Cottopsis Girard, Proc. Bost. Soc. Nat. Hist., III, 1850, p. 303 (*asper*).
Potamocottus Gill, Proc. Bost. Soc. Nat. Hist., VIII, 1861, p. 40 (*punctulatus*).
Tauridea Jordan and Rice, Man Vert. E. U. S., 2d Ed., 1875, p. 255 (*ricei*).

Fresh water sculpins. Body fusiform. Head feebly armed; skin smooth or more or less velvety, its prickles, if present, not bony or scale-like; villiform teeth on jaws and vomer, and sometimes on palatines. Gill openings separated by a wide isthmus, over which the membranes do not form a fold; no slit behind fourth gill. Branchiostegals 6; suborbital stay flat, without a ridge, no ridges on opercle. Dorsals nearly or quite separate, the first of 6 to 9 slender spines; ventrals moderate, each with a short concealed spine and 4 soft rays; pectoral rays usually all simple, lower ones always so. Lateral line present usually more or less chain-like, sometimes incomplete. Preopercle with a simple spine at its angle which is usually curved upward, its base more or less covered by skin, very rarely obsolete; usually 2 or 3 spines turned downward below this; subopercle usually with a concave spine turned downward. Vertebræ 10+23—33; pyloric cæca about 4. Fishes of small size, inhabiting clear waters in the northern parts of Europe, Asia, and America. The species are extremely numerous, and are very difficult to distinguish, all being very similar in form, coloration, and habits. The Miller's Thumb, or Blob, in Japan called Kajika, is found in most streams and lakes where trout occur, and it is one of the most destructive enemies of the trout, devouring its eggs in great numbers.

(*Cottus;* κόττος, an old name of the European Miller's Thumb, *Cottus gobio*, Linnæus, from κόττα head).

a PEGEDICTIS. Preopercular spines 4; palatine teeth present, D. VIII–14 or 15; A, 13 or 14 ..... *kazika*, 16.

aa COTTUS. Preopercle with but one distinct spine; palatine teeth obsolete, D. VIII–16 to 18; A, 11 to 13 ..... *pollux*, 17.

16. COTTUS KAZIKA Jordan and Starks, new species.

Head $2\frac{2}{3}$ in length without caudal; depth $4\frac{3}{4}$. Dorsal VIII–14 to 16; anal 13 to 15; ventral I, 4. Pores of lateral line 28; eye $4\frac{2}{3}$ in head; interorbital (bone only) 8; maxillary $2\frac{1}{5}$; snout 4; height of caudal peduncle $4\frac{1}{2}$ to 5.

Body deepest at shoulders; head somewhat depressed, the snout narrow; a notch in profile at front of eyes. Mouth rather large; the maxillary reaching to below posterior margin of pupil; lower jaw included

FIG. 15.—COTTUS KAZIKA.

or even with upper. Teeth in broad bands on jaws, vomer, and palatines; those on palatines in bands as wide as on vomer and equally conspicuous, somewhat coarser than those on jaws. Interorbital space concave and continuous behind with a broad shallow concave area on top of head, which is between low inconspicuous rounded parietal ridges. Nasal spine sharp; between them are the slightly produced processes from the premaxillaries. Edge of preopercle armed with 4 spines, all sharp, the upper one very strongly hooked upward, the next much smaller, pointing backward, the next hooked downward, and the lowest pointing forward. A small sharp spine on lower anterior end of subopercle directed forward.

Fin formulæ of 7 specimens: 5 specimens have 15 dorsal rays; 1 has 16; 1 has 14; 3 specimens have 14 anal rays; 2 have 13; 2 have 15. Longest dorsal spine 5 in head; longest soft ray 3; tips of last dorsal rays not nearly reaching base of caudal. Pectoral reaching a little past front of anal; it has 17 rays, the fifth to the eighth from the top the longest, $1\frac{2}{5}$ in head. The distal fourth or fifth of ventrals extends over the median point between their base and origin of anal. Origin of anal midway between tip of snout and distal sixth of caudal. Caudal truncated, its length $1\frac{3}{4}$ in head.

Body rough with small prickles; top of head appearing similar to body under a lens, but smooth to the touch.

Color brownish or slate color on back and head, under parts white; sides crossed with 4 conspicuous, black, oblique, cross bars extending downward and slightly forward; one not evident as the others under front of spinous dorsal; one under fifth to seventh dorsal rays, growing narrower below and nearly reaching front of anal; a narrower one under last dorsal rays, and one across base of caudal; the rays of pectoral, dorsals, and caudal with black spots forming irregular bars across fins; anal and ventrals white; lips with black spots; chin dusky. Small specimens show a white crescent on nape in front of dorsal, the bars more conspicuous, and the interspaces lighter, sometimes white immediately behind bars from dorsal to lower parts.

This species differs from *Uranidea reinii* (Hilgendorf) and *Uranidea dybowskii* (Hilgendorf) in having the ventral rays I, 4, in having 4 preopercular spines rather than 3, and in having teeth on the palate; from the former in having a large head, nasal spines developed, ventrals not nearly reaching to anal and much shorter soft dorsal; from the latter in having the height of head much less (5 to $5\frac{1}{2}$ rather than $3\frac{1}{2}$ in length, without caudal), in having fewer pores in lateral line and in color, the conspicuous cross bars not being described. Hilgendorf describes 7 anal rays for *U. dybowskii*, which number is doubtless a misprint. Four specimens taken in the streams at Niigata and at Tsuruga; the largest, the type, is 9 cm. in length, the smallest 6 cm.

The type is numbered 7705, Ichthyological Collections, Leland Stanford Junior University Museum, and is from Niigata, where it was obtained by Mr. Eitaro Iiijima, a student in Stanford University. Cotypes are numbered 50918, U. S. N. M.

(*kajika*, the Japanese name of river sculpins.)

17. COTTUS POLLUX Günther.

KAJIKA.

Cottus pollux GÜNTHER, Ann. and Mag. Nat. Hist., 1873, p. 240; Otaru in Hokkaido (Ishikari River).—ISHIKAWA, Prel. Cat., 1897, p. 42; Tokazu River.
Cottus hilgendorfi STEINDACHNER and DÖDERLEIN, Beiträge zur Kennt. der Fische Japan's, III, 1884, p. 40; IV, pl. IV (near Tokyo, probably Tana R.).—ISHIKAWA, Prel. Cat., 1897, p. 48; Tsugaru, Uzen, Iwashiro, Shimotsuki, Chichibu, Yamashiro, Kai, Kamo R., Katsura R., Tokyo.

Head $3\frac{1}{4}$ to $3\frac{2}{5}$ in length without caudal; depth 5 to $5\frac{1}{2}$. D. VIII or IX-16 to 18; anal 11 to 13. Eye 5 in head; maxillary 2 to $2\frac{2}{5}$ in head; interorbital width $\frac{3}{5}$ of eye; bone only $\frac{1}{3}$ in eye.

Body slender and head rather small. Teeth in moderate bands on jaws, narrower on vomer; palatines toothless. Lower jaw included. Maxillary variable with size; in the smaller examples (10 cm. long) it does not reach past posterior margin of pupil; in the larger ones (14 cm. long) it reaches to posterior border of eye. Preopercle with but one small hooked spine, usually covered by the skin; subopercle with a very small spine at its anterior lower end. Interorbital concave; top of head evenly rounded.

Length of ventrals variable; in the largest examples they nearly always reach to or cover the vent; in the smaller ones they sometimes reach to vent or sometimes to end within a distance of vent equal to the diameter of the eye. Pectoral reaches to opposite front of anal, its length $1\frac{1}{6}$ or $1\frac{1}{4}$ in head. Dorsal spines slender, the longest two-thirds or three-fourths of the longest soft rays. Longest anal rays 2 in head. Caudal slightly rounded; its length $1\frac{1}{2}$ in head. Skin everywhere perfectly smooth.

Color grayish or brown above, lighter or white below; back with 5 crossbars, the first under front of spinous dorsal, the next near posterior end of spinous dorsal, the others more conspicuous and longer, the middle one more oblique than the others, running from under the fourth to seventh dorsal rays, becoming narrower below and reaching obliquely forward to toward a point just in front of anal, the next bar under last dorsal rays and continued downward to light under parts, the fifth across base of caudal. Some specimens are uniform brown or gray above, shading rather suddenly but evenly to the lighter below; others especially the smaller ones are mottled with white and the line on lower parts between the light and the dark is much broken up and irregular, sometimes the back and the top of head plentifully sprinkled with small dark spots; the rays of the dorsals, pectoral, and caudal are spotted with dark, making irregular lines across fins; anal and ventrals usually white; sometimes on the large specimens there are a few spots on the anal rays and the tips of the ventrals are dusky.

Cottus hilgendorfi is certainly the same as *Cottus pollux*. The only

alleged difference is that the former is said to have D. VIII–17 (VIII–18, in figure), instead of IX–19, and that the ventrals reach to within an eye diameter of the vent. All these variations are represented among our specimens. Our very many specimens are from the Tana River at Tachikawa near Tokyo, from the Semida River at Tokyo, from the Kitakami River near Morioka, from the Kinu River at Utsonomiya, from Niigata in Echigo, from the river at Aomori, and from Kamashiro.

(*pollux*, a twin.)

The following are the fin formulæ and localities of our specimens:

	Tana River.				Kitakami River.			
Dorsal	VIII, 17	VIII, 18	IX, 17	IX, 18	IX, 17	IX, 17	IX, 16	VIII, 17
Anal	12	12	12	11	13	12	12	13

	Kitakami River.						Semida River.	
Dorsal	VIII, 18	IX, 17	VIII, 16	IX, 16	IX, 17	VIII, 17	IX, 17	IX, 18
Anal	13	12	12	12	12	13	12	13

	Aomori.				Niigata.		Kinu River, Utsonomiya.		Kamashiro.
Dorsal	IX, 17	IX, 18	IX, 17	IX, 17	IX, 18	IX, 19	VIII, 16	IX, 17	IX, 17
Anal	13	13	12	12	12	13	13	13	12

16. URANIDEA DeKay.

Uranidea DeKay, New York Fauna, Fishes, 1842, p. 61 (*quiescens*=*gracilis*).

This genus is very close to *Cottus*, from which it differs in the reduction of its ventrals to a concealed spine and 3 soft rays. The skin is smooth or very nearly so, the preopercular spine small, and there are usually no teeth on the palatines. Brook fishes, smaller in size than most of the species of *Cottus*, and with fewer ventral rays; the genus very doubtfully distinct. We refer to this genus, with some doubt, two Japanese species not represented in our collections.

(οὐρανός, sky; εἶδον, I looked, i. e., stargazer.)

a Head 3½ in length; D. IX–17 to 20 ..... *reinii*, 18.
aa Head 2½ in length; D. IX–14 ..... *dybowskii*, 19.

18. URANIDEA REINII (Hilgendorf).

Cottus reinii Hilgendorf, Sitzungsbericht der Gesellschaft naturforschender Freunde zu Berlin, 1879, p. 105; "Yeso and South Nippon."

Head 3½ in length, without caudal; depth of head 5⅓. Dorsal IX, 17 to 20; anal 13 to 15; pectoral 13 to 16; ventral 1, 3.

Vomer toothed. Skin of head with raised points; over the pectoral are fine prickles; no spines on snout. Preopercle with 3 spines, the upper one simple and curved, the two lower ones directed forward; subopercle with a covered spine on the lower anterior edge. Lateral

line complete. Front of anal somewhat farther from the tip of the snout than from the base of the caudal. Ventral reaches to anal. Spinous dorsal three-fourths as high as the soft dorsal. Gill membrane not continuous across isthmus. Diameter of eye somewhat less than length of snout, and somewhat greater than interorbital width. The maxillary reaches to somewhat behind the middle of the eye.

Color chocolate brown with darker spots and several irregular crossbars; fins with spots. Yeso and South Nippon; fresh water (Hilgendorf).

(Named for Professor Rein.)

19. URANIDEA DYBOWSKII (Hilgendorf).

Cottus dybowskii HILGENDORF, Sitz. der Gesell. natur. Freunde zu Berlin, 1879, p. 106; no locality named.

Head 2½ in length, without caudal; depth of head 3½. Dorsal IX–14; anal 7 (17?); pectoral 17; ventrals, 1, 2 (?); lateral line 37.

Vomer toothed. Nasal spines developed. Skin of head with papillæ; sides without prickles. Preopercle with 3 spines, the upper 2 directed backward; a smooth spine at the opercle, that on interopercle directed forward; superscapular with a spine. Front of anal nearer to the base of caudal than to tip of snout. Ventral not reaching to anal. Diameter of eye equal to length of snout; wider than the interorbital. The maxillary nearly reaches to the posterior edge of eye.

Color dark brown marbled with white; underside white; ventral and anal with dark; dorsal, pectoral, and caudal with white bands; back with round light spots in color similar to that on belly. (Hilgendorf.) The locality of this species is not specified.

(Named for Professor Dybowsky.)

17. RHEOPRESBE Jordan and Starks.

Rheopresbe JORDAN and STARKS, new genus (*fujiyamæ*).

This genus differs from *Cottus* and *Trachidermus* in having the pectoral rays all branched; from *Cottus* in the flat depressed head with long postorbital portion; body not elevated anteriorly, and particularly in the backward position of the anal and vent, which are well behind the middle of the entire length; ventrals not nearly reaching halfway from their base to front of anal. It differs from *Trachidermus* in having the suborbital stay flat as in *Cottus*, the gill membranes widely joined to the isthmus, in not having ridges on top of head and in having top of head convex.

Rivers of Japan, a large fish similar to *Cottus* in habit, but well distinguished by the branched rays of the pectoral.

(*ῥέω* to flow swiftly; *πρέσβη*, first born, in allusion to the Japanese name Takitaroō, first born of the Cataract.)

20. RHEOPRESBE FUJIYAMÆ Jordan and Starks, new species.

TAKITAROŌ.[a]

Head 3 in length without caudal; depth 6. Dorsal VII–15; anal 14; eye 5½ in head; interorbital space 5½; maxillary 2⅙.

Head and anterior part of body depressed, the body scarcely deeper than the head; upper profile of head very gently curved, nearly straight from dorsal to premaxillary processes, thence bluntly rounded to snout, jaws even. Mouth rather large; maxillary reaching to posterior margin of orbit; anterior end of premaxillary on a level with middle of eye. Teeth small cardiform; the band on mandible moderate and widened but little anteriorly; that on premaxillary narrow at the side, rather wide anteriorly; teeth on vomer and palatines similar to those on jaws, in bands as wide as at front of premaxillary. Interorbital space wide, concave, and without ridges; top of head nearly flat, very slightly convex. Nasal spines acute, but not sharp; not projecting through the skin. Preopercle spine sharp and

FIG. 16.—RHEOPRESBE FUJIYAMÆ.

strongly hooked; 3 blunt spines below it, not projecting through the skin, the lowest hooked forward. Snout very slightly longer than eye; postorbital part of head 1½ times combined length of snout and eye. Skin everywhere smooth.

Pectoral rather broadly rounded behind, not reaching to opposite vent; it has 17 rays, all branched, the lower rays divided 3 or 4 times, the middle ones about 6 times; the fifth to seventh rays from the top the longest, 1⅔ in head. Length of ventrals, 2⅓ in length of head and 2½ times in distance from their base to front of anal; they have one concealed spine and 4 rays. Origin of dorsal just behind a line drawn between tip of opercle flaps. Spinous dorsal low and rounded in outline, its second to fourth spines subequal in length, three-fifths of longest soft rays, which are equal to combined length of snout and eye. Dorsal and anal rays, except the first, 1 or 2 branched, their tips not divided over 2 or 3 times. Origin of anal midway between tips of caudal rays and middle of eye; anal ray from the fourth to within a couple of the last are subequal, their length 3½ in head. Caudal slightly rounded, its length 2¼ in head.

[a] *Taki*, waterfall, *taroō*, firstborn.

Color, head and back dark brown, lighter on sides, belly white; a dark bar under the fourth to seventh dorsal ray running obliquely forward and downward toward front of anal; a similar one under last part of soft dorsal, and one across base of caudal; top of head mottled with small dark spots; lips dark brown, under parts of head dusky; dorsal spines dark brown, the membrane white, soiled with diffused dusky spots; the dorsal rays dark brown, with small light spots, causing light streaks obliquely across the rays, the membrane white. Caudal brown, with darker brown irregular cross streaks; anal white, each ray with 2 dark spots toward its tip; ventrals white.

Our single specimen was presented by Professor Mitsukuri. It bears a label in Japanese saying, "Locality unknown," and also a label in English stating that it came from Odawara, a town on Sagami Bay, near the foot of the famous sacred mountain of Fuji or Fujiyama. It also says that the vernacular name is "Takitaroō," first born of the cataract. It is a female full of spawn and is 21 cm. in length.

The type is numbered 7706, Ichthyological Collections, Leland Stanford Junior University Museum.

18. MYOXOCEPHALUS (Steller) Tilesius.

Myoxocephalus STELLER MS., 1741.
Myoxocephalus TILESIUS, Mém. Acad. Sci. Petersb., IV, 1811, p. 273 (*stelleri*).
Acanthocottus GIRARD, Proc. Bost. Soc. Nat. Hist., III, 1849, p. 185 (*grœnlandicus*).
Cottus PUTNAM, Bull. Mus. Comp. Zool., I, 1863, p. 3 (*scorpius*), not of Linnæus.
Boreocottus GILL, Proc. Ac. Nat. Sci. Phila., 1859, p. 166 (*axillaris*).

Body slender or robust, subfusiform, covered with thick skin, in which are sometimes embedded prickly plates; deciduous, granular, or stellate tubercles also sometimes present, but no true scales. Head large. Mouth terminal, large, the lower jaw always included, the uppermost the longer; villiform teeth on the jaws and vomer, none on the palatines; suborbital stay strong; preopercle with 2 strong straight spines above directed backward, and 1 below directed downward and forward; opercle, nasal bones, orbital rim, and shoulder girdle more or less armed; gill membranes forming a fold across the rather narrow isthmus; slit behind last gill small or wanting, if present, reduced to a mere pore; vertebræ about 28. Branchiostegals mostly 6. Dorsal fins 2, separate, the first short, its spines rather slender; ventral rays I, 3; caudal fin moderate, fan-shaped; pectoral fin broad, its lower rays procurrent. Lateral line well developed, its tubes sometimes provided with bony or cartilaginous plates, never chain-like nor reduced to separated pores. Species numerous, in the seas of northern regions; coarse fishes, little valued as food.

Nearly all of the Japanese species differ from those from the north in the absence of rough bony plates, even in specimens 13 inches long.

(*μυοξός*, the dormouse; *κεφαλή*, head; the allusion not evident.)

a. Compressed tubercles or pointed spines over eye and at occiput; no filaments behind eye.

b. Anal rays 12; second preopercular spine moderate.....*polyacanthocephalus*, 21.

bb. Anal rays, 14; second preopercular spine very short, not one-fourth length of upper; anal fin usually plain; head very long and flat; body with round, rough plates above.....*jaok*, 22.

bbb. Anal rays, 13; second preopercular spine long, one-third or more length of upper; anal fin with 4 black crossbands; spines and ridges on top of head high and sharp; top of head sparsely covered with warts.....*edomius*, 23.

aaa. No spines or tubercles over eye or occiput; a pair of postorbital filaments; preopercular spines 3.

c. Ridges on head high and continuous; interorbital space and top of head deeply concave; lower parts with small white spots.....*nivosus*, 24.

cc. Ridges on head scarcely developed; interorbital space shallowly concave; top of head evenly rounded from side to side; chin and throat with black and white markings.....*raninus*, 25.

21. MYOXOCEPHALUS POLYACANTHOCEPHALUS (Pallas).

Cottus polyacanthocephalus PALLAS, Zoogr. Rosso-Asiat., III, 1811, p. 133; Aleutian Islands; no definite locality.—GÜNTHER, Cat., II, p. 166.—JORDAN and GILBERT, Synopsis, 1883, p. 704.

Myoxocephalus polyacanthocephalus JORDAN and GILBERT, U. S. Fur Seal Comm., III, p. 463, pl. LXIII; Unalaska, Robben I., St. Paul, Unga, etc.—JORDAN and EVERMANN, Fish. N. and M. Amer., II, p. 1976.

FIG. 17.—MYOXOCEPHALUS POLYACANTHOCEPHALUS.

Head $2\frac{1}{2}$ in length; depth $4\frac{1}{4}$; D. IX or X-13 to 16; A. 11 to 13. Body rather elongate. Head long and narrow, somewhat compressed, concave between the orbits, the orbital rim being elevated; lower jaw included; nasal spines strong; a strong ridge above eye, with a blunt, compressed spine behind it; behind this a small digitate cluster of ridges ending in low spines; behind these an irregular, broken ridge on each side of the vertex, extending to the occiput; outside of this another ragged ridge; suborbital stay strong, striate; upper preopercular spine very long, straight, simple, striate at base, longer than eye; a similar but shorter spine below it, not one-half as long, and the usual downward-directed spine at lower edge of preopercle and subopercle; opercular spine moderate. Skin of top of head thin, with

small, smooth warts, not hiding the occipital ridges; no cirri. Mouth rather large, the maxillary reaching beyond eye, one-half length of head; skin of body with some scattered, rough tubercles, usually nearly smooth. Dorsals not very high; dorsal spines slender; pectorals reaching anal; ventrals moderate, I, 3. A minute pore usually present behind last gill, this sometimes wholly wanting. Lateral line complete. Dark olive above, much variegated with darker and reddish; belly mostly whitish; sides and belly (in males) with numerous blackish reticulations surrounding large white spots; jaws dusky, mottled with whitish; membrane joining maxillary to preorbital black, with round white spots in the adult, more or less plain in the young; fins, all but the ventrals, mottled and barred with blackish and yellowish. Length 1½ to 2½ feet. Alaska to Kamchatka; abundant throughout Bering Sea, and southward along the islands to Puget Sound; one of the largest sculpins and everywhere familiar to fishermen. Recorded from Robben Island, Unalaska, Bristol Bay, Chignik Harbor, the Pribilof and Commander islands, and at Petropaulski.

(πολύς, many; ἄκαγθα, spine; κεφαλή, head.)

22. MYOXOCEPHALUS JAOK (Cuvier and Valenciennes).

Cottus jaok Cuvier and Valenciennes, Hist. Nat. Poiss., IV, 1829, p. 172; Kamchatka (Coll. Pallas; specimen in Mus. Berl. called *Cottus scorpius* by Pallas).—Günther, Cat., II, 1860, p. 165.—Jordan and Gilbert, Synopsis Fish. N. Amer., 1883, p. 705.

Myoxocephalus jaok Jordan and Gilbert, Rept. Fur Seal Comm. for 1896–97, 1899, p. 462; Petropaulski, Robben Island.—Jordan and Evermann, Fish N. and M. Amer., II, 1898, p. 1977.—Schofield, Rept. Fur Seal Comm., III, 1898, p. 499; Port Clarence; Grantley Harbor.

Cottus humilis Bean, Proc. U. S. Nat. Mus., IV, 1881, p. 149; Chamisso Island, Bering Straits (Coll. T. H. Bean); D. X, 16; A. 13.—Jordan and Gilbert, Synopsis Fish. N. Amer., 1883, p. 705; St. Michael, Eschscholtz Bay, Point Belcher.)

Cottus polyacanthocephalus Kner, Sitzb. Akad. Wiss. Wien, LVIII, 1868, p. 21, pl. iv, fig. 11; Decastris Bay; not of Pallas.

Cottus tæniopterus Bean and Bean, Proc. U. S. Nat. Mus., 1896, p. 384; not of Kner.

D. VIII to X–15 to 17; A. 13 to 15 (usually D. IX–16; A. 14). This species has a very slender body and an extremely wide, flat head, the latter strikingly triangular when viewed from above, on account of the regular way in which it tapers toward the snout. The species is further distinguished by possessing but 9 dorsal spines and by the presence in the adult of an irregular series of circular spinous plates above the lateral line, these plates wanting in very young individuals. They begin to make their appearance in specimens 6 inches long, and are invariably present in larger specimens. In adults, the region below the lateral line contains strong spinous prickles mostly concealed in the skin and directed backward. Some of the anterior ones

may be broader and may have more than one point, but none is circular with a rosette of short spinous points, as is the case with the dorsal series. Lower jaw included; top of head covered with small warts; scapular spine short and sharp; humeral spine obscure; upper preopercular spine very long, nearly as long as eye, low, sharp, 3 times length of next spine, not quite reaching tip of opercular spine. Occipital crests long, gently converging behind, suddenly diverging near their posterior ends. Distance from supraorbital to occipital tubercle 1½ times the distance between the 2 supraorbital tubercles (the 2 measurements about equal in *M. polyacanthocephalus*); 2 or 3 low digitate ridges behind supraocular spine; a sharp ethmoidal ridge extends backward from level of small spines to above front of pupil; mouth very large, the maxillary extending to posterior border of eye; the pore always present behind last gill arch; spinous dorsal low, the interval between dorsals unusually long; fins moderate; pectoral barely reaching anal; ventrals not to vent. Color olive grayish, mottled with darker, paler than in related species; back with 4 dark cross bands, made up of blackish spots; lower side of head and belly plain white; membrane of upper jaw unspotted; fins, all except the ventrals, with oblique dark bars, fainter than in most species. In the adult, the dark cross bands break up into sharply defined black spots, with vermiculating blotches and lines which closely cover the back. Length 12 to 18 inches. (Jordan and Gilbert.) Bering Sea, shallow water; everywhere common on both coasts, extending into the Arctic and south to the Amur River and Unalaska. Our specimens from Unalaska, Bristol Bay, Petropaulski, Robben Reef, Port Clarence, and Grantley Harbor; one of the most characteristic fishes of Bering Sea.

(*jaok*, the vernacular name in Kamchatka.)

23. MYOXOCEPHALUS EDOMIUS Jordan and Starks, new species.

Head 2½ in length, without caudal; depth 5⅔. Dorsal VIII or IX–14 to 16; anal 13. Lateral line 41. Eye 5⅔ in head; interobital 7⅙; snout 3⅗; maxillary 2⅕; upper preopercular spine 5; pectoral 1⅔; first dorsal spine 4⅕; third dorsal spine 3½; longest dorsal rays 2⅔; longest anal rays 3⅗; ventral 2½; caudal 2.

Head and anterior part of body depressed; body round posteriorly, nowhere compressed. Interorbital space uniformly concave, a very slight median ridge anteriorly. Mouth large; lower jaw included; maxillary reaching to under posterior orbital margin. Very small conical teeth in bands on jaws and vomer; the band on mandible not widened anteriorly; the vomerine patch rather strongly curved, the greatest width across is greater than the vertical diameter of eye, scarcely equal to horizontal diameter. Nasal spines strong Ridges on each side of vertex high and rather broken up, converging back-

ward and ending in strong backward-directed spines, which are higher than the ridges, though not so high as the ocular spines. Outside of this ridge is a shorter ragged ridge. The highest spines on top of head are the ocular spines, just over posterior fourth of orbit; they are much higher than in *M. polyacanthocephalus*. Digitate spines all directed backward, the anterior part of ridge behind eye forming one, inside of which there is a very small one, and outside 2 small ones. Post-temporal spine long and sharp, not reaching to end of opercular flap; humeral spine shorter, in a line with opercular spine. Opercle with a strong ridge ending in a sharp spine. Lower anterior end of subopercle with a small but very acute spine directed backward and downward. Preopercular spine long, straight and strong, nearly reaching to edge of gill opening; the spine below it not half so long; the usual downward-directed spine at lower edge of preopercle, above which the edge of preopercle is straight and smooth without a trace of

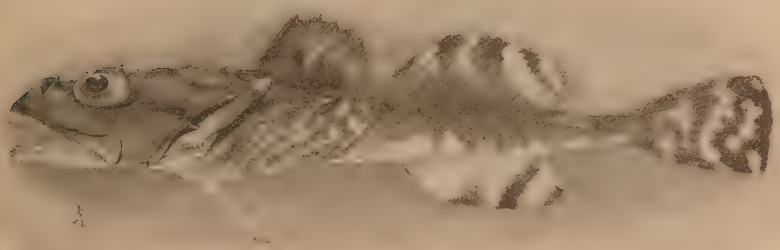

FIG. 18.—MYOXOCEPHALUS EDOMIUS.

a fourth spine. Suborbital stay keeled. Top of head sparsely covered with conspicuous warts, which do not at all obscure the spines or ridges. Skin entirely naked and with no trace of plates.

Depressed spinous dorsal just reaches to first dorsal ray. Soft dorsal highest anteriorly, the rays growing only slightly lower backward. Tips of last anal and dorsal rays on the same vertical. Pectorals rather broadly rounded, reaching to opposite front of soft dorsal. Ventrals reaching a little over half the distance from their base to front of anal. Caudal truncate.

Color light brown above, without bars or stripes; lower parts white; lower lip dusky, under part of head otherwise white; spinous dorsal with some dusky mottling in front and behind; soft dorsal dusky with transparent spots regularly placed indicating cross bars; caudal crossed with 2 or 3 rather wide, wavy dark bands; anal white, partly crossed by 4 black spots; ventrals white.

This species is nearest to *M. polyacanthocephalus* of Kamchatka and Alaska, but differs in color; in having much higher, sharper ridges and spines on top of head, a larger eye, and in the more scattered warts on head.

This description is taken from the type which was collected at the Aino village of Edomo, near Mororan. A single cotype was collected at Hakodate, No. 50919, U.S.N.M.

The type is 19 cm. in length and is numbered 7707, Ichthyological Collections, Leland Stanford Junior University Museum.

24. MYOXOCEPHALUS NIVOSUS (Herzenstein).

Cottus nivosus HERZENSTEIN, Mélanges Biologiques du Bull. Acad. Imp. Sci. Petersb., XII, 1890, p. 113; St. Olga Bay.

Myxocephalus nivosus JORDAN and GILBERT, Fish. Bering Sea, in Rept. Fur Seal Invest. for 1896–97, 1899, p. 461.—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 1984; Iturup Island.

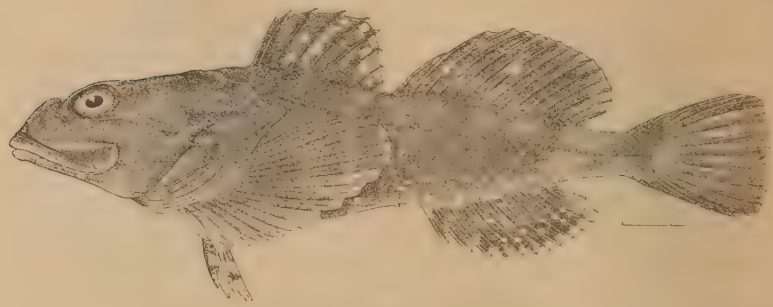

FIG. 19.—MYOXOCEPHALUS NIVOSUS.

Head $2\frac{1}{4}$ in length without caudal; depth $4\frac{1}{3}$. Dorsal IX–15; anal 12; lateral line 36. Eye $5\frac{1}{2}$ in head; interorbital width 8; snout $4\frac{1}{3}$; maxillary $2\frac{1}{3}$; upper preopercular spine $7\frac{1}{2}$; pectoral $1\frac{2}{3}$; first dorsal spine $4\frac{2}{3}$; third dorsal spine 3; longest dorsal rays $2\frac{3}{5}$; longest anal rays $3\frac{1}{6}$; ventral $2\frac{1}{5}$; caudal 2.

Head long and comparatively narrow, not depressed; about as deep as wide; body a little compressed behind tip of pectoral. Postorbital part of head equal to twice length of snout and once vertical diameter of eye. Interorbital space wide and rather deeply concave. Maxillary reaching to posterior border of eye. Lower jaw included; a knob developed at symphysis. Teeth small, conical, in rather wide bands on jaw and vomer; the distance across vomerine patch equal to vertical diameter of eye. Nasal spines moderate, not very sharp. Ridges on each side of vertex continuous, slightly broken but without tubercles; they converge toward occiput. Top of head between ridges rather deeply concave. The usual ridges outside of these are low and short. There is no trace of a superorbital spine, of digitate spines behind eye, or of occipital spines. A pair of short, simple

filaments at occiput on angle of ridge, and a pair on outer edge of ridge a short distance behind eye. Preopercular spine very short; its tip not reaching over two-fifths of distance from its base to end of opercular flap; it is very slightly curved upward. The spine next below is not half as long; it points backward and slightly downward; the lower end of preopercle bears the usual forward-directed spine; the spine on subopercle is very small; opercular ridge rather low and rounded, ending in a spine. Posttemporal spine long and sharp, scarcely reaching to above tip of opercular spine. Humeral spine scarcely developed; completely covered by opercular flap. Suborbital stay low; not keeled. Top of head rather thickly covered with large warts; skin of body with very much scattered, fine spines, sometimes double, not at all of the nature of the rough, bony plates sometimes found in other species.

Tips of dorsal spines, when fin is depressed, reach to base of second or third dorsal ray. Soft dorsal moderately high; not at all connected with spinous dorsal; the last ray adnate to caudal peduncle; tips of last rays reach beyond those of anal. Pectoral broadly rounded, reaching to opposite front of soft dorsal. Ventrals reaching three-fifths of distance from their base to front of anal. Caudal slightly convex, either closed or open.

Color light brown above, white below; no crossbars or radiating lines about eye; branchiostegal region and under part of mandible very slightly dusky, mottled with round white spots; pectoral dusky, somewhat barred with white spots; dorsals irregularly mottled with light dusky; anal light dusky, obliquely crossed with faint light lines; caudal dark, crossed with very narrow faint white lines; ventrals white.

Our specimens of this species were collected by Messrs. Jordan and Snyder, at Same, Mororan, and Hakodate. A specimen was obtained in 1896 at Iturup Island by the U. S. Fish Commission steamer *Albatross*. Here described from a specimen from Same, 27 cm. in length.

Dr. Schmidt writes me that he regards this species as a color-variant of *Myoxocephalus brandti* (Steindachner), described from the mouth of the Amur.

(*nivosus*, snowy.)

25. MYOXOCEPHALUS RANINUS Jordan and Starks, new species.

GISUKAJIKA.

Head $2\frac{2}{5}$ in length without caudal; depth $4\frac{1}{3}$; dorsal IX–13; anal 11; lateral line 40. Eye $6\frac{1}{2}$ in head; interorbital 6; snout $4\frac{1}{5}$; maxillary $2\frac{1}{5}$; upper preopercular spine 8; first dorsal spine $9\frac{1}{2}$; third dorsal spine $4\frac{3}{4}$; longest dorsal ray $2\frac{2}{3}$; longest anal ray $3\frac{1}{3}$; pectoral $1\frac{3}{4}$; ventral $2\frac{1}{4}$; caudal 2.

Head very short, broad, depressed, and evenly rounded from side to side; the sides of head not at an angle with top, as in *Ainocottus*

ensiger. Body slightly compressed posterior to tips of pectoral. Interorbital space very wide and very shallowly concave, at once distinguishing it from all other known Japanese forms. Maxillary reaching to posterior border of eye. Lower jaw included; knob at symphysis scarcely developed. Sharp, small, conical teeth in bands on jaws and vomer; the greatest width across vomerine patch a little greater than length of eye. Nasal spines very small, covered by the skin. Ridges on top of head scarcely developed, covered with thick, warty skin; top of head not concave. No spines above orbit or occipital. Low digitate processes may be felt under the skin. A pair of short, simple filaments behind eye. Preopercular spine very short and stout, reaching one third of the distance between its base and end of opercular flap; it is straight along its upper edge and slightly curved along its lower. Next spine below about a third of the length of the large spine; it is inclined somewhat downward. The usual spine on lower edge of preopercle inclined forward; above it the edge of preopercle is straight and smooth to the second spine. Spine on

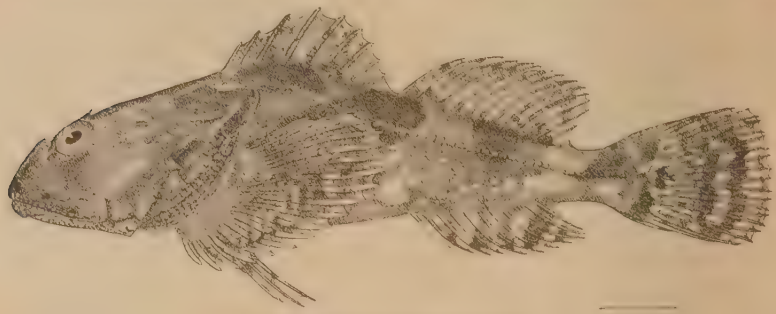

FIG. 20.—MYOXOCEPHALUS RANINUS.

anterior edge of suboperclе very short and blunt. Ridge on opercle low and ending in a blunt spine. Posttemporal spine short and sharp, not produced through the skin; its tip does not reach so far posteriorly as opercular spine. Humeral spine not developed. Suborbital stay very low. Skin nowhere with plates. Top of head thickly covered with large, rather soft warts.

Dorsals low, well separated; tips of spines when fin is depressed do not reach soft dorsal by a distance equal to length of pupil. Tips of last dorsal and anal rays on the same vertical. Pectoral with 18 rays; its tip reaching to opposite front of soft dorsal. Ventrals reaching two-thirds of distance from their base to front of anal. Caudal truncate; the outer rays rounded.

Color, brown above, lighter below; a very conspicuous, sharp-cut, white cross band runs obliquely downward and forward across caudal peduncle just behind base of last dorsal ray; its width equal to height of caudal peduncle; sides of belly with large, round, white spots nearly

as large as eye, separated narrowly by the light-brown ground color; many of the spots are run together; lips, under part of mandible, chin, and branchiostegals spotted and specked, snowflake-like, with irregular white spots; dorsals and pectorals irregularly and finely mottled; the lower edge of pectoral bordered with white; ventral white, crossed with 2 dark spots, and with alternate irregular bands of white and dark brown; a white spot on lower edge of caudal peduncle; a white bar across base of caudal rays, behind which are two or three wavy dark bands across rays.

This species somewhat resembles *Myoxocephalus niger* of the Pribilof Islands, though not closely. The warts on head do not terminate in filaments. The color is very different, resembling more closely *M. stelleri*, of Kamchatka, and the patch of vomerine teeth is very much larger. It may be known from *M. stelleri* (= *Cottus decastrensis* Kner), the nearest species, by the flatter interorbital and scarcely developed ridges on head, by the less spotted membrane behind maxillary and preopercle, and especially by the white membrane connecting lower lip with maxillary. In *M. stelleri* the dorsal rays are never less than IX–15.

The above description is of the type which was taken by Jordan and Snyder at Aomori. It is 24 cm. in length. Cotypes were taken at Same, Mororan, Aomori, and Hakodate.

The type is numbered 7708, Ichthyological Collections, Leland Stanford Junior University Museum. Cotypes are No. 50920, U.S.N.M.

(*raninus*, frog-like, from the markings of the throat.)

26. MYOXOCEPHALUS STELLERI Tilesius.

Myoxocephalus stelleri TILESIUS, Mém. Acad. Petersb., IV, 1811, p. 273 with plate, not referred to in text; Petropaulski (Coll. G. W. Steller).—JORDAN and GILBERT, Rept. Invest. Fur Seal Islands, III, 1898, p. 463, pl. LXIV*a*; Bering Island.—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 1981; Petropaulski.—SCHMIDT, Faune Mer Japon, 1903, p. 115; Japan Sea, Okhotsk Sea.

Cottus decastrensis KNER, Denk. Kais. Akad. Wissen., XXIV, 1865, p. 2, pl. II, figs. 1, 1*a*; Decastris Bay, near mouth of the Amur.

? *Cottus marmoratus* CUVIER and VALENCIENNES, Hist. Nat. Poiss., VIII, 1831, p. 497; Petropaulski; on a drawing by Mertens.

D. IX (rarely VIII)–15 (rarely 16); A. 12 (11 to 13). Resembling in shape *M. polycanthocephalus*, the head less depressed and the snout deeper than in *M. jaok*. Characteristic features are the thickened papillose lips, the presence of a supraocular tentacle, and the peculiar coloration. Skin naked, or with a few scattered small plates in adult males, the interorbital deeply concave, and the occipital and parietal ridges heavy and more or less broken or rugose. Head $2\frac{2}{7}$ to $2\frac{2}{5}$ in length; depth 4; least depth of caudal peduncle $1\frac{1}{2}$ in snout; greatest width of head equaling distance from tip of snout to base of

preopercular spine; depth of head at occiput equaling one-half its length. Mouth large, the lower jaw included, but less conspicuously overlapped than in *M. jaok*, the maxillary reaching beyond the eye, $2\frac{1}{4}$ in head. Lips very thick and fleshy in adults, the inner margin of each with a dense band of fine papillæ; lower lip may also bear externally a few papillæ or short filaments; a fleshy slip or filament often present on upper posterior angle of maxilla. Nasal spines pungent, rather short; preopercle with two diverging spines at angle and a third remote one below directed downward and forward; the upper spine varying in length, but extending usually about halfway to tip of opercular spine; opercle with a strong rib and spine; humeral and subopercular spines strong; interorbital width $5\frac{1}{2}$ to 6 in head, gently concave, its floor usually with traces of two low ridges; a definite supraorbital tentacle borne on the anterior end of the occipital ridge, its basal tubercle never conspicuous; slender occipital tentacle often present, especially in the young, but not infrequently absent; ridges

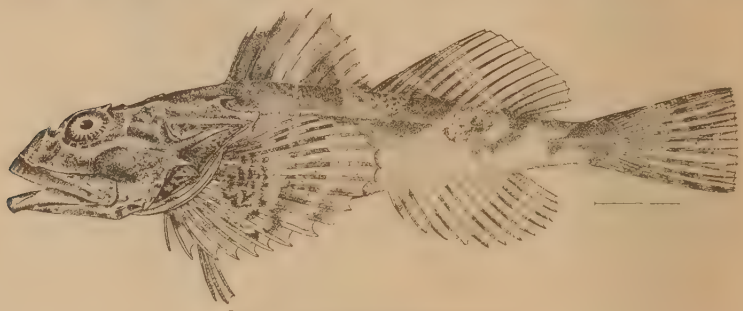

FIG. 21.—MYOXOCEPHALUS STELLERI.

on occiput strong, often irregular or partly interrupted, their surface roughened with lengthwise lines or with clusters of granules; occiput more deeply concave than in *M. polyacanthocephalus;* usually a cluster of short digitate ridges behind the eye; top and sides of head with small, warty protuberances. A minute pore behind last gill, to be detected with difficulty in the young. Dorsals with short interspace or none, the membrane from last spine usually joining base of first soft ray; spinous dorsal very high in adult males, the fifth spine highest, one-half as long as head, longest soft ray $2\frac{1}{5}$ in head; pectorals reaching front of anal, the ventrals not to vent; vertical fins much lower in the young. Skin smooth, without plates or spines in young 7 or 8 inches long; 1 adult male of 14 inches with scattered small subcircular spinous plates, all but a few of which are below the lateral line. In the young, the maxillary and mandibular membranes are whitish, very conspicuously marked with irregular, jet-black spots and blotches; branchiostegal and gular membranes and the membrane behind the preopercle crossed with narrow dark streaks; entire under

side of head faintly dusky, mottled and maculated with white "like a frog's belly;" iris with small black spots and blotches; these colors fainter in our adult specimen, where the under side of head is nearly uniform whitish; the maxillary membranes, however, conspicuously black spotted; body brownish, with 3 light-gray saddles, the most conspicuous crossing the back of the caudal peduncle immediately behind the dorsal fin; the second below the dorsal notch, and the third, often obscure or wanting, forming a V-shaped area on top of head, the 2 arms diverging from interorbital space toward the base of opercular spine; the dark areas often lighter centrally, and variously blotched and mottled with brown or dusky; dorsals very irregular in the marking; anal usually with 3 or 4 oblique dark bars; caudal usually with a basal translucent bar followed by varying alternations of translucent and black; ventrals showing 2 black crossbars; pectorals with no definite color pattern on their outer face, but crossed on their inner face by a few irregular black bars. Males show the usual round white spots on sides of abdomen. It is well distinguished by the speckled throat and belly, aptly compared by Steller to the speckled color of a frog. Western shore of Bering Sea and Okhotsk Sea; not recorded from Alaska or the Aleutian Islands. This description from 11 specimens from Petropaulski and Bering Island, taken by the U. S. Fish Commission steamer *Albatross*. This species is now recorded from Bering and Medni Islands, Petropaulski, and the mouth of the Amur River. Recorded by Dr. Peter Schmidt from near Vladivostok and from Saghalin.

(Named for Georg Wilhelm Steller.)

27. MYOXOCEPHALUS BRANDTI (Steindachner).

Cottus brandti STEINDACHNER, Ichth. Notizen, V, 1867, p. 6, pl. III, figs. 1, 2; mouth of the Amur River. (Type, in Vienna Mus.)

Myoxocephalus brandti JORDAN and EVERMANN, Fish. N. and M. Amer., II, p. 1984, 1898 (copied).—SCHMIDT, Faune de la Mer du Japon, etc., 1903, p. 15; Japan Sea.

Head $2\frac{2}{3}$; depth 5. D. IX 13; A. 11; P. 17. Head narrowed forward, the lower jaw included. Eye 6 in head, a little larger than snout; interorbital space strongly concave, $1\frac{1}{2}$ in eye. A rather long tentacle above eye posteriorly; behind this a ridge, low and rather sharp, converging with its fellow, and inclosing a depressed quadrangular area; no spine at its posterior end; nasal spines prominent; preorpercle with 3 spines, the upper shorter than eye, the second not one-half its length, the third short, blunt, and turned downward; opercular spine, blunt, concealed; suprascapula with a single long spine. Top of head covered with small rounded warts. Lateral line with thin, bony concealed plates, its pores sending numerous simple branches above and below; below the lateral line 2 rows of small cross plates, tube-like, apparently connected with the system of tubes of

the lateral line; no rounded bony plates or scales. Longest dorsal spine 3 in head; pectoral moderate, a little more than one-half head; ventral 2½ in head. Head bluish violet above; sides of body reddish yellow; violet marblings on the lower lip and on the sides of the lower jaw, leaving the ground color to form ocellated spots; fins violet with yellow spots, the ventrals uniform yellowish. Known from 1 specimen 13 inches long from the mouth of the Amur River. (Steindachner.) Also recorded by Dr. Schmidt from Peter the Great Bay, Vladivostok.

19. MEGALOCOTTUS Gill.

Megalocottus Gill, Proc. Ac. Nat. Sci. Phila., 1861, p. 166 (*platycephalus*).

This genus includes large sculpins, with broad, flat heads, differing from *Myoxocephalus* chiefly in the sharp projecting lower jaw; the preopercle has 3 spines, the upper short and straight, the lowermost turned downward; dentation as in *Myoxocephalus;* suprascapula with 2 spinous projections; top of head warty; sides with rounded tubercles in the adult; lateral line of separated pores; a large pore behind last gill. North Pacific.

(μεγαλός great; *Cottus.*)

28. MEGALOCOTTUS PLATYCEPHALUS (Pallas).

Cottus platycephalus Pallas, Zoogr. Rosso-Asiat., III, 1811, p. 135; Kamchatka, after Steller.—Cuvier and Valenciennes, Hist. Nat. Poiss., IV, 1829, p. 177.

Cottus taeniopterus Kner, Sitzber Ak. Wiss. Wien, LVIII, 1868, p. 18, pl. xiv, fig. 10; Decastris Bay, near mouth of Amur River. (No. 5574, Mus. Wien.)

Megalocottus platycephalus Gill, Proc. Ac. Nat. Sci. Phila., 1861, p. 166.—Jordan and Gilbert, Rept. U. S. Fur Seal Comm., III, 1898, p. 469.—Jordan and Evermann, Fishes N. M. Amer., II, 1898, p. 1987, fig. 725, St. Michael.—Schmidt, Faune Mer, Japon, 1903, p. 15; Japan Sea, Okhotsk Sea.

Head 3 in length, D. VIII 13; A. 12; V. I, 3; P. 16 or 17; lateral line 40. Lower jaw somewhat longer than upper; eye 5 in head, as long as snout; nasal spines distinct; orbital rim moderately prominent; a low ridge behind it toward the occiput, without spines or points. Top of head between these ridges forming a quadrangular depression, as broad as the eye in front, but narrower behind. Top of head covered with naked, warty skin. Preopercle with 4 spines, the upper as long as eye, directed upward and backward, the second much shorter, the others directed downward. Opercle with a long, forked ridge, ending in two short diverging spines; a spine directed downward on subopercle; two sharp spines on scapular region, the lower the longer and touching the first tube of the lateral line. Lateral line complete, above, its numerous rounded bony plates armed with spines as in *M. laticeps;* these in 2 rows anteriorly and 1 posteriorly; a few similar plates below lateral line. Fins all high, the soft dorsal especially so. Color dark, with many dark shades and spots on throat and belly,

especially on gill membranes; sides and belly (in males) with irregular, round white spots; first dorsal with round, pale spots, the membranes otherwise largely dusky; soft dorsal with 3 or 4 dark oblique cross shades, between which are rows of pale spots; anal with 4 dark oblique cross shades; between which are rows of pale spots; first dorsal with round pale spots, the membranes otherwise largely dusky; soft dorsal with 3 or 4 dark oblique cross shades, between which are rows of pale spots; anal with 4 dark oblique cross shades; caudal with 3 narrower dark stripes; pectoral with 4; ventrals dusky with pale spots. Okhotsk Sea and western and northern parts of Bering Sea. This description (after Kner) from a single specimen, 7½ inches long, from Decastris Bay, near the mouth of the Amur. We have not seen the species, but Dr. Schmidt lists it as from the Japan Sea, his collections

FIG. 22.—MEGALOCOTTUS PLATYCEPHALUS.

being made in Peter the Great Bay, near Vladivostok. The plate, from Jordan and Evermann, was drawn from a specimen collected at St. Michaels, Alaska, by Mr. L. M. Turner. It seems to belong to this species.

(πλατύς, broad; κεφαλή, head.)

20. AINOCOTTUS Jordan and Starks.

Ainocottus JORDAN and STARKS, new genus (*ensiger*).

This genus is allied to *Myoxocephalus*, having the general form and appearance of the large sculpins. It has, however, four preopercular spines, as in *Porocottus*, but the upper is very long and straight, and not hooked as in *Porocottus*. There is no slit behind the last gill, a character which separates *Ainocottus* from *Oncocottus*, to which it is technically nearest in relationship. *Ainocottus* lacks also the high fins and the comb-like crest of the males of *Oncocottus*.

(*aino*, the white aborigines of the island of Hokkaido; *Cottus*.)

29. AINOCOTTUS ENSIGER Jordan and Starks, new species.

Head 2⅕ in length without caudal; depth 5. Dorsal X-14; anal 12. Lateral line 38. Eye 6 in head; interorbital 7¼; snout 2⅖; maxillary

2; upper preopercular spine $6\frac{3}{4}$; pectoral 2; first dorsal spine $4\frac{2}{5}$; third dorsal spine $3\frac{3}{4}$, longest dorsal rays $3\frac{1}{5}$; longest anal rays $3\frac{3}{8}$; ventral $2\frac{3}{4}$; caudal $2\frac{1}{3}$.

Head long and but little depressed; the sides forming an angle with the top. Body nowhere compressed. Postorbital part of head equal to snout and twice the verticle diameter of eye. Interorbital space wide and uniformly concave. Maxillary reaching the diameter of pupil beyond eye. Lower jaw but slightly included; a knob developed at symphysis. Teeth small, conical, in rather wide bands on jaws and vomer; the band strongly curved on the latter; its greatest width equal to length of orbit. Nasal spines strong, not very sharp. Ridges on each side of vertex not continuous, represented by a short double spine behind orbital spine (first digitate spine), and a longer one at occiput, between which there is a rounded raised area, but

FIG. 23.—AINOCOTTUS ENSIGER.

scarcely a ridge. The ridge outside of this is low and uneven. The highest spine on top of head is the superorbital spine, which is situated over posterior fifth of orbit; behind it are two digitate spines, both directed backward. Preopercular spine long, straight and sharp, nearly reaching edge of opercle; below it are three spines, the upper one the largest, scarcely a third as long as the large spine, the lower one is directed forward and downward as usual, while the one between is more obtuse than the others, and is directed downward and slightly backward. Opercle with a long, strong ridge ending in a spine; the length of ridge and spine equal to twice the vertical diameter of eye. Lower end of subopercle and upper end of interopercle each with a sharp spine, their points converging and nearly touching; the upper one pointing downward and backward, the lower one upward and backward. Posttemporal spine long and sharp, ending about on a vertical with preopercular spine. Humeral spine triangular and

blunt, not nearly reaching as far as long opercular flap. Suborbital stay scarcely keeled, but produced in a rounded ridge. Top of head comparatively rather sparsely covered with very hard warts. Skin everywhere naked, with no trace of plates anywhere. No slit behind last gill.

Spinous dorsal when depressed does not reach to first ray of soft dorsal. Soft dorsal high and short. Last rays of dorsal and anal slightly adnate to body, the latter at base only; tips last rays on the same vertical. Pectoral broadly rounded, the rays just below the third or fourth from the top the longest, reaching to opposite tips of last dorsal spines when depressed. Ventrals reaching half the distance from their base to front of anal. Caudal truncate, or very slightly rounded when spread, a little concave when partly closed.

Color very light, slaty brown on back and upper part of sides; white below; a dark cross band on back under posterior end of spinous dorsal, and one under each end of soft dorsal; a dark bar at base of caudal and one across caudal toward posterior end, leaving a broad white margin at tips of rays; head light, somewhat mottled; no bars from eyes; lips with alternate white and light dusky spots; underpart of head and belly white; spinous dorsal with an irregular large, dusky blotch at each end; soft dorsal with 2 or 3 dusky, irregular, oblique cross bands; upper part of pectoral mottled with white spots on a dusky ground, which changes to light and dark crossbars below; anal white, crossed by 2 dusky, oblique bands; ventrals white.

This species somewhat resembles *Myoxocephalus verrucosus* and *M. jaok*, but may be known at once by the lack of plates on body and by the presence of four preopercular spines.

The above description from the type, which was taken at Hakodate by Jordan and Snyder. It is 30 cm. in length. Three cotypes were taken at the same locality.

The type is numbered 7709 Ichthyological Collections, Leland Stanford Junior University Museum. Cotypes are 50921 U.S.N.M.

(*ensiger*, sword bearing.)

21. POROCOTTUS Gill.

Porocottus Gill, Proc. Ac. Nat. Sci. Phila., 1859, p. 166 (*quadrifilis*).

This genus is near *Myoxocephalus*, differing in the presence of 4 preopercular spines, the uppermost hooked upward. Lower jaw included. Lateral line modified, giving off pairs of divergent branches with pores at their ends. Cirri present above eye and on nape. Northern Pacific.

(πόρος, pore; *Cottus*.)

30. POROCOTTUS TENTACULATUS (Kner).

Cottus tentaculatus KNER, Sitzber. Akad. Wiss. Wien, LVIII, 1868, p. 22, pl. v, fig. 12; "Singapore;" evidently an error. (No. 5591a Wien. Mus.)—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 2000; after Kner.

Head 3½. D. VI–16 or 17; A. 14 or 15; V. I, 13, P. 14 or 15. Head small, mouth small, the lower jaw included; eye large, 3 in head, longer than snout; interorbital space channel-like, less than one-half diameter of eye; a sharp spine before each eye, on which is a fringed tentacle; supraocular ridge ending in a blunt, forked, bony knob, on which is a small thread-like tentacle; the quadrangular interspace between these two sets of tentacles is excavated; preopercular spine long, curved upward, two-thirds diameter of eye; the second spine much shorter and turned backward; 2 spines lower, turned downward; subopercle with a spine turned downward; a similar one on opercle; maxillary reaching to middle of eye; lower jaw with large pores. Dorsal fins low, the rays flexible, the two close together; ventrals reaching vent; pectorals past beginning of anal. Skin of body wholly naked; lateral line complete, bending downward on caudal peduncle. Color clear brown, darker above, the head above with a few large dark-brown spots, which form obscure bands, 1 of these from front of eye across upper lip, second broader from eye across subopercle; lower jaw speckled; throat and breast plain yellowish; back with about 6 dark cross bands, those most anterior the broadest; sides of body with a network of brown streaks around pale spots; a large bright yellow spot at base of caudal; fins all finely spotted with whitish and dotted with dark, the caudal with 5 or 6 dark cross bands; pectorals faintly barred. (Kner.) A single specimen, 2 inches long, said to be from Singapore, which is of course an error. It probably came from the Pacific coast of Asia, perhaps from Yezo or Decastris Bay.

(*tentaculatus*, having tentacles.)

22. ARGYROCOTTUS Herzenstein.

Argyrocottus HERZENSTEIN, Mélanges Biol. Ac. Imp. Sci., XIII, 1892, p. 219; St. Petersburg.

Spinous dorsal short; ventrals extremely long, their tips extending beyond front of anal fin; gill membranes scarcely united to the isthmus, forming a broad fold across it, no slit behind the last gill; teeth on the vomer, none on the palatines; skin entirely naked, without scales or bony plates; preopercles with 3 small spines. North Pacific.

(ἄργυρος, silver; *Cottus*.)

31. ARGYROCOTTUS ZANDERI Herzenstein.

Argyrocottus zanderi HERZENSTEIN, Mélanges Biol. Ac. Imp. Sci., XIII, 1892, p. 219; Korsakow, Sakhalin. (Type No. 9679, Mus. St. Petersburg. Coll. Dr. Zander.)—JORDAN and GILBERT, Fish. Bering Sea, in Rept. Fur Seal Invest. for 1896–97, III, 1899, p. 460, pl. LX; Iturup Island.—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 1995; Iturup Island.

Head $3\frac{1}{8}$; depth $4\frac{5}{6}$. D. VIII–15; A. 13; P. 14; V. 3; C. 18; lateral line with 35 tubes. Eye $3\frac{5}{9}$ in length of head; interorbital space $1\frac{5}{8}$ in eye; 2 well-developed crests at the vertex; maxillary reaching middle of eye; lower jaw slightly projecting; 2 anal spines; 3 small spines on preopercle, the upper half as long as the eye, turned upward, the others directed downward; longest dorsal spine one-half length of head; pectoral reaching ninth ray of soft dorsal; ventrals reaching to the next to the last ray of anal. Color brownish, dark above, with numerous silvery spots bordered with darker, a silvery

FIG. 24.—ARGYROCOTTUS ZANDERI.

stripe from below the eye to the base of the lower jaw; another from eye to angle of preopercle; a row of 6 large irregular spots along middle of sides, many smaller ones below these; 2 smaller irregular spots behind these; a bell-shaped spot with a point directed upward on the belly between the ventrals; the first dorsal with its upper margin blackish, with milk-white spots dotted with black; a transparent spot at base of fourth and sixth rays; a small transparent spot near base of fourth ray; another behind sixth; about these spots the coloration is darker; soft dorsal almost uniformly dark; anal colorless, its border dark, with 2 or 3 dark spots on each ray; caudal uniformly dusky, the upper and lower rays blackish, with clear spots; ventral with darker cross streaks; pectorals with dark rings and streaks. Ventral in female probably much shorter than in male, the color less marked. Three specimens of this beautifully marked Cottoid taken in Shana Bay, Iturup Island, show the following characters: The branchiostegal membranes are widely joined across the throat, narrowly united in

front of the middle line of isthmus, with a rather wide free margin behind; lateral line without plates; nasal spines small; 4 short spines on preopercular margin. These specimens answer well to the detailed description of the type, but are still more ornate, in that they possess along the back a number of broad dark bars alternating with lighter bars, the former confluent below, with the ground color of the sides. In the largest specimen, 7 cm. long, the ventral fins extend only to base of third anal ray. There are no tubercles on the rays, and the membranes extend nearly to tips of the 2 outer rays, and two-thirds length of the inner ray. The ventral spine is slender, nearly as long as the inner ray, and is firmly adnate to outer ray. The smaller specimens are, respectively, 4 cm. and 3.5 cm. long, the ventrals reaching in one to front of anal, in the other to vent; fins are finely cross barred, more variegated than in the type. (Jordan and Gilbert.) Known only from Sakhalin Island, 1 specimen 92 mm. long (Herzenstein), and Iturup Island, where 3 specimens were obtained by the U. S. Fish Commission steamer *Albatross* in 1896; our description from the latter.

(Named for its discoverer, Dr. Zander.)

23. ZESTICELUS Jordan and Evermann.

Zesticelus JORDAN and EVERMANN, Check-List Fishes, 1896, p. 443 (*profundorum*).

Deep-sea sculpins, closely allied to *Porocottus*, but with the skeleton little developed, the head soft and spongy, filled with mucous channels, the skin perfectly smooth, the lateral line reduced to a series of separate open pores, the vertical fins few-rayed and weak. Preopercular spine slender, curved upward. Deep seas; 2 species known; probably degraded from *Porocottus*, the soft skeleton and feeble structure being results of deep-sea life.

(ζεστός, soft-boiled; *Icelus*, a son of the god of sleep.)

32. ZESTICELUS BATHYBIUS (Günther).

Cottus bathybius GÜNTHER, Rept. Fishes Challenger, 1887, p. 62, pl. x, fig. C; off Tokyo.

This species is thus described by Dr. Günther:

D. 5 to 10; A. 7; P. 17, V. 3. The preoperculum is very strongly armed. There are two spines arising from the same root at the angle, one in front of the other, the posterior being longer than the eye; three other shorter spines along the lower edge of the preoperculum; operculum with a small spine at its antero-inferior angle. A pair of spines on the occiput behind a deep depression occupying nearly the whole of the vertex. Eyes longer than the snout, close together. Minute teeth on the vomer, but none on the palatine bones. Tail much attenuated. Pectoral fin extending beyond the origin of anal; ventrals not reaching the vent. Second dorsal fin higher than first; length of the caudal two-fifths of that of the body (without head). Muciferous system much developed, opening by wide pores along the lower jaw, the preoperculum, the infraorbital ring and the lateral line. Grayish-brown; throat and all the fins black.

Habitat.—South of Yeddo, Japan, Station 235; depth 565 fathoms. One specimen, 2½ inches long.

A small specimen from off Misaki was seen in one of the museums in Tokyo, but our notes in regard to it are mislaid.

(βαθύς, deep; βιός, living.)

24 COTTUNCULUS Collett.

Cottunculus COLLETT, Norges Fiske, 1875, p. 20 (*microps*).

Body tadpole-shaped, the head extremely large, the body tapering rapidly from the shoulders to the slender tail; mouth rather large, terminal, oblique, the jaws about equal; villiform teeth in the jaws; a double patch on vomer; no teeth on the palatines; no spines on the head, the tubercular surface of the skull covered by skin; skull thin, its bones not firm. Gills 3½, no slit behind the last arch; gill mem-

FIG. 25.—COTTUNCULUS BREPHOCEPHALUS.

branes broadly joined to the isthmus, their union extending to above the lower edge of the base of the pectorals. Pseudobranchiæ very small; no cirri, scales, or prickles; the skin thin and movable, smooth, or roughened with small warts. Spinous dorsal little developed, the 2 fins usually continuous; spines very slender, flexible, embedded in the skin; pectorals short, procurrent below; ventrals very short, well separated, their rays I, 3; caudal rounded. Deeper parts of the Atlantic.

(A diminutive of *Cottus*.)

33. COTTUNCULUS BREPHOCEPHALUS [a] Jordan and Starks.

Head 2⅓ in length without caudal; depth 3¼. Dorsal VI–16; anal 12. Eye 4½ in head; maxillary 2⅓.

This species may be known by the absence of blunt spines and by the coloration.

[a] This species is described in detail and figured in the Proceedings of the U. S. National Museum, XXVI, 1903, p. 689.

The type was dredged by the U. S. Fish Commission steamer *Albatross* in Suruga Bay in 94 fathoms, Station 3704. It is 13 cm. in length, and bears the number 50591, U.S.N.M.

(βρέφος, baby; κεφαλή, head, from its resemblance in feature to the shaven-fronted babies (kishibozu) in Japan.

25. GYMNOCANTHUS Swainson.

Gymnocanthus SWAINSON, Class. Fish., etc., II, 1839, p. 271 (*ventralis*).
Phobetor KRÖYER, Naturh. Tidschr., I, 1844, p. 263 (*tricuspis*).
Elaphocottus SAUVAGE, Nouv. Arch. Mus. Paris, (2), I, 1878, p. 142 (*pistilliger*).

Body slender or robust, subfusiform, covered with thick skin in which are sometimes embedded prickly plates; deciduous, granular, or stellate tubercles also sometimes present, but no true scales. Head large; mouth terminal, large, the lower jaw always included, the uppermost the longer; villiform teeth on jaws, none on palatines or vomer; suborbital stay strong; preopercle with 4 spines, the upper very strong and armed above with 2 to 5 antler-like processes; opercle nasal bones, orbital rim, and shoulder girdle more or less armed; gill membranes forming a fold across the rather narrow isthmus; slit behind last gill small or wanting, if present reduced to a mere pore; vertebræ about 28. Branchiostegals mostly 6. Dorsal fins 2, separate, the first short, its spines rather slender; ventral rays I, 3; caudal fin moderate; pectoral fin broad, its lower rays procurrent. Lateral line well developed, its tubes sometimes provided with bony or cartilaginous plates.

(γυμνός, naked; ἄκανθα.)

a. Interorbital space not armed with bony plates; pectoral fin with fringes on the inner side of the rays. D. IX–14; A. 16 ..... *pistilliger*, 34.
aa. Interorbital space armed with bony plates; no fringes on pectoral.
b. D. IX or X–14 or 15; A. 15 ..... *intermedius*, 35.
bb. D. X or XI–17; A. 18; mouth very large ..... *merzensteini*, 36.

34. GYMNOCANTHUS PISTILLIGER (Pallas).

Cottus pistilliger PALLAS, Zoogr. Rosso-Asiat., III, 1811, p. 43; Unalaska.—CUVIER and VALENCIENNES, Hist. Nat. Poiss., IV, 1829, p. 193.—GÜNTHER, Cat., II, 1860, p. 167.
Cottus ventralis CUVIER and VALENCIENNES, Hist. Nat. Poiss., IV, 1829, p. 194; Kamchatka (Coll. Mr. Collée, type in Brit. Mus.).—GÜNTHER, Cat., II, 1860, p. 167.
Cottus cephaloides GRAY, in Cuvier and Valenciennes, Hist. Nat. Poiss., IV, 1829, p. 194; Kamchatka. (Type of *C. ventralis*.)
Elaphocottus pistilliger SAUVAGE, Nouv. Archiv. Mus., 1878, p. 142.
Gymnocanthus pistilliger GILBERT, Rept. U. S. Fish Comm., 1893 (1896), p. 424.—SCOFIELD, Rept. Fur Seal Comm., III, 1898, p. 503; Grantley Harbor—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 2006—JORDAN and GILBERT, Rept. U. S. Fur Seal Comm., III, 1898, p. 460; Petropaulski, Robben Island, Bristol Bay, Kyska, Point Belcher, Cape Tchaplins, Bering Island.

D. IX–14; A. 16. The dorsal fins are widely separated, the interspace equal to one-half or more than one-half the diameter of the

pupil. The vertebræ 12 + 24. An obtuse prominence above hinder margin of orbit bears in young individuals a slender cirrus, which frequently disappears in adults. Behind the eye a continuous occipital ridge bears 3 smaller bony prominences, the first immediately behind the eye, the second and third approximated at posterior end of ridge; these bear no cirri. In males the post axial region is furnished with a number of very slender filaments, each of which is expanded at tip into a compressed frond-like lamina, having the free edge more or less laciniate or fringed. These expanded tips are bright white and very conspicuous. No trace of them is present in females, but they develop in males at a very early age. These agree with the structures described by Pallas, on which he based the name *pistilliger*. The upper preopercular spine is sharply bifurcate in even our smallest specimens (50 mm.), but in these no trace of a second medial upwardly

FIG. 26.—GYMNOCANTHUS PISTILLIGER.

directed spine is present. The latter is evident in specimens 70 mm. and more in length, and a small concealed prominence representing a third spine is exceptionally present. No trace of slit behind last gill.

Very young examples show no groups of granulations on head or nape, these being usually wanting in specimens less than 100 mm. long. In older examples they are variously developed, the degree of armature dependent neither on age nor sex. They are never armed on interorbital space, the granulations being confined to the occipital and nuchal regions, with an additional elongate patch on the upper part of the opercle. In highly developed males the dorsal and ventral rays are accompanied with series of tubercles. The color is brown above, with very narrow vermiculating lines of lighter; a black blotch on cheek, more conspicuous in males, and 4 inconspicuous cross bars on back; the darker dorsal area is bounded below lateral line by an

irregular series of dark streaks or blotches. In males, the lower jaw and preopercle is cross-banded with black and light yellow; the abdomen, lower half of sides in front of anus, and prepectoral region, with large roundish white spots, separated by vermiculating areas, rendered dusky by aggregations of coarse black dots; ventrals dusky and silvery, the latter frequently forming cross bands; spinous dorsal dusky or black, with irregular series of white spots not confined to basal parts of fin. In both sexes the pectorals, second dorsal, and caudal are translucent or yellowish, crossed by narrow black bars. The females are more numerous than the males in our collection, but the disparity in number is not so great as has been found by other writers. In 45 specimens examined as to this, 17 are males, 28 females. Among specimens obtained at Petropaulski and at the U. S. Fish Commission steamer *Albatross* station 3646, off Robben Island, in 18 fathoms, no males are included. (Gilbert.)

Coasts of Alaska; taken abundantly in Bristol Bay in 4½ to 26 fathoms, and about Robben Island and the coast of Kamchatka.

(*pistilla*, pistil; *gero*, I bear; in allusion to the axillary papillæ of the male.)

35. GYMNOCANTHUS INTERMEDIUS (Schlegel).

Cottus intermedius SCHLEGEL, Fauna Japonica, Poiss., 1843, p. 38; coast of Jezo.—GÜNTHER, Cat. Fish, II, 1860, p. 167; copied.

Gymnocanthus intermedius GILBERT, Rept. U. S. Fish Comm. for 1893, 1896, p. 424.

Cottus filamentosus SAUVAGE, Rev. Mag. Zool., III, 1875, p. 279; Hawaiian Islands (by error).

Head 2⅞ in length without caudal; depth 4½. Dorsal IX or X–14 or 15; anal 15; lateral line 37. Eye 4 in head; interorbital space (bone) 11; snout 4; maxillary 2⅜.

Upper profile of head straight and gently sloping from dorsal to eye, thence rounded to front of eye and slanting straight and steep at snout. Interorbital concave, shallow, without ridges or channels. Top of head concave between a pair of slight rounded ridges that run back from each eye. Suborbital stay rather prominent. Lower jaw included; maxillary reaching to below middle of eye, or varying from that point to below posterior margin of pupil. Very small conical sharp teeth on jaws; the bands wider in front; no teeth on vomer or palatines.

Angle of preopercle with a long sharp spine, which reaches just past edge of opercle; above it bears 3 or 4 sharp antler-like processes. Edge of preopercle below with 3 moderate, sharp spines of about equal size; the upper one directed downward and backward, the other two directed downward and forward. Nasal spines well developed. Over posterior margin of eye is a blunt tubercle which bears a rather large simple tentacle. Top of head without bony tubercles as in *G. pistilliger*. A prominent sharp humeral spine just above base of pectoral.

Lateral line with concealed bony plates. A very few scattered ctenoid plates behind pectoral base present in both sexes. No axillary tentacles. Top of head with close set, rough plates, which usually extend between eyes nearly to nasal spines; no plates on upper part of preopercle or opercle.

Third dorsal spine the highest, $1\frac{3}{4}$ in head in females, in males $1\frac{2}{5}$; the first spine $2\frac{1}{5}$ in females; $1\frac{3}{4}$ in males; the spines behind the fourth rapidly decrease in length, so that the posterior border of the fin is nearly vertical; the last spine one-third eye in length. Dorsals separated by an interval equal to that between spines at base. Soft dorsal lower than spinous; the longest rays $2\frac{1}{8}$ in head in female, 2 in male; the last ray is not adnate; tips of last rays do not reach nearly so far back as those of anal, which do not reach nearly to base of caudal; pectoral with 19 rays, 3 or 4 below the third are the longest; they reach to above base of fourth anal ray in the female and are $1\frac{1}{6}$ in head; in the male they reach to above fifth or sixth anal ray and are equal to the head's length.

The inner ray of the ventral is the longest; it reaches to the vent in the female, to the base of the seventh anal ray in the male. Caudal almost imperceptibly concave when the fin is closed, truncate or slightly convex when spread; its length is $1\frac{4}{5}$ in the female, $1\frac{3}{5}$ in the male.

Color slaty, profusely spotted with small, irregular dark spots, with or without obscure cross bars; when present there is 1 under middle of spinous dorsal, 2 under soft dorsal, and 1 halfway across caudal peduncle; lower part of sides and belly white; a large black blotch occupies cheek below suborbital stay; opercle below preopercle spine black; membrane between upper branchiostegal rays dark, the rays white; spinous dorsal dark and irregularly mottled, or with a couple of transparent oblique streaks; soft dorsal transparent and with 2 or 3 conspicuous black streaks obliquely across the rays; pectoral white, crossed toward posterior end with 3 or 4 nearly vertical black streaks; caudal white, crossed with 3 or 4 curved black bands; ventrals and anal white. The following color was taken from a fresh specimen: Olive, finely mottled with brown, salmon red shades on sides; fins barred; the dorsal, anal, caudal, and pectoral washed with salmon red, brightest on pectoral and caudal; ventral white, faintly barred with salmon; lower side of head more or less yellow.

Here described from specimens from 18 to 22 cm. in length from Hakodate.

This species may be known from *G. pistilliger* by the longer, better armed preopercle spine, the wider and shallower interorbital space which is rough with plates, the absence of axial tentacles or fringes on inner side of pectoral rays, the absence of bony tubercles on top of head, and by the presence of the superorbital tentacle in all ages.

Specimens were taken at Hakodate, Same, and Otaru. A small specimen from Hokkaido (858 in his preliminary catalogue) was received from Ishikawa.

Dr. Sauvage describes a species of *Gymnocanthus* from the impossible locality of the Hawaiian Islands. It is probably based on a Japanese specimen of *Gymnocanthus intermedius*.

D. IX–16; A. 13; P. 15. No teeth on vomer. Two strong spines at the end of the snout; no spines at the orbit; space between the eyes concave, very narrow; nape rounded, without spines or tubercles. A strong bifid preopercular spine. Gill openings separated by an isthmus. Lateral line almost straight. Color yellowish, maculate, with small black spots; a black band at the base of the caudal; fins with black lines, formed of small points. (Sauvage.)

The mixing of Japanese and Hawaiian species in collections has frequently occurred, as most steamers bound from San Francisco to Japan stop at Honolulu.

36. GYMNOCANTHUS HERZENSTEINI Jordan and Starks, new species.

Head $2\frac{3}{4}$ in length without caudal; depth $4\frac{2}{3}$ to 5. Dorsal X or XI–17; anal 18; lateral line 40. Eye $4\frac{3}{5}$ to $4\frac{3}{4}$ in head; interorbital width

FIG. 27.—GYMNOCANTHUS HERZENSTEINI.

10; snout $3\frac{1}{2}$; maxillary $2\frac{1}{4}$. Length of fin rays of female: first dorsal spine $2\frac{1}{6}$ in head; third spine 2; ninth spine $4\frac{1}{2}$; last spine 8; fourth dorsal ray $2\frac{3}{4}$; middle pectoral rays $1\frac{2}{3}$; ventrals 2; caudal $2\frac{1}{5}$. Fin rays of male: first dorsal spine $2\frac{1}{5}$; third spine $1\frac{3}{4}$; ninth spine $2\frac{1}{2}$; last spine $7\frac{1}{2}$; fourth dorsal ray $2\frac{1}{5}$; pectoral $1\frac{2}{3}$; ventrals $1\frac{1}{2}$; caudal $1\frac{4}{5}$.

Head and body everywhere about as deep as wide; body round in section; head flat or slightly concave above, the sides joining at an angle; snout steep. Mouth large, the maxillary reaching to below posterior orbital rim; interorbital shallow, concave, without ridges or channels. Lower jaw the shorter. Sharp conical teeth in bands on jaws; the band on lower jaw narrow, not widened in front; much wider in front on premaxillary; vomer and palatines toothless. Angle of preopercle with a long stout spine, not reaching edge of opercle, armed above with 3 sharp anther-like processes; lower edge of

preopercle with 3 sharp subequal spines, the upper one directed downward and backward, the middle one downward, and the lower one hooked forward. Nasal spines well developed. On top of head from eye running backward is a low, rounded ridge, which is scarcely broken, though shows slight indications of tubercles.

Over posterior margin of eye is a prominent blunt tubercle which does not bear a tentacle. Top of head thickly covered with rough bony plates which extend forward on interorbital space to front of eye. Similar plates on opercle, top of preopercle and on cheek behind eye. Humeral spine very short and blunt, not nearly so long as in *G. intermedius*.

Lateral line with concealed bony plates. A few rough scattered plates behind pectoral base much more numerous and regular in the male than in the female; no axial tentacles.

Middle dorsal spines the longest; spinous dorsal rather high in front, the spines growing rapidly shorter behind the middle in the female, holding their length nearly to the last in the male. Dorsals well separated. Soft dorsal highest anteriorly, the rays growing gradually shorter posteriorly; the last ray not adnate; tips of the last rays not reaching so far posteriorly as do those of anal, which do not reach to within a diameter of the eye of the base of the caudal. Pectorals with 19 rays, its posterior outline broadly rounded, reaching to above base of second anal ray in the female, to above fourth anal ray in the male. Middle ventral ray the longest, not reaching vent in female, reaching past vent nearly to anal in male. Caudal rather deeply concave, even when fin is spread; the outer rays half the diameter of the eye longer than the middle ones.

Color nearly uniform light slaty brown above, in spirits, without spots or crossbars, changing abruptly to silvery white just below middle of sides; a diffused dusky blotch on cheek; membrane behind maxillary dark slate-color; branchiostegals dusky in male; silvery white in female; spinous dorsal with 3 black or dark brown bands following the upper outline of the fin, the upper one bordering the upper edge; posteriorly the bands are broken; in the female they are narrow and diffused, and in the male they are broad, conspicuous, and wider than the white interspaces; similar bands on soft dorsal showing the same modifications in both sexes, but running obliquely downward and backward; 2 dark cross bands on caudal; 3 and the beginning of a fourth vertical dark cross bands on pectoral, wider on male; anal and ventrals white in female; the former with an indistinct dusky longitudinal band in male.

In life the body is largely cherry-red, the pectorals golden, with whitish tips and black bands bordered with bright orange; maxillary orange; chin and belly white; orange bars on back; a brick-red band across top of head.

This species may be known from *G. intermedius*, which it most resembles, by the increased number of fin rays, the longer maxillary (longer than in any of the known northern Pacific forms) and by the shorter humeral spine, and by many minor characters.

Two specimens, a male and a female, were taken by Jordan and Snyder at Hakodate. The male is the type; it is 26 cm. in length and is numbered 7710, Ichthyological Collections, Leland Stanford Junior University Museum.

(Named for the late Dr. Solomon Herzenstein, of St. Petersburg, in recognition of his excellent work on the fishes of the Hokkaido.)

26. CROSSIAS Jordan and Starks.

Crossias JORDAN and STARKS, new genus (*allisi*).

This genus is related to *Pseudoblennius* and *Bero*, probably closer to the latter. It differs from them in having 3 ventral rays; no palatine teeth; a single pair of multifid flaps on top of head behind orbital flaps; the tip of each dorsal spine fringed with cirri; and in having no external intromittent organ. Lateral line pores arranged in pairs above and below main sensory canal, which is not protected by concealed plates, and does not form a double curve anteriorly. Japan.

(κρόσσος, fringes.)

37. CROSSIAS ALLISI Jordan and Starks, new species.

Head $2\frac{4}{5}$ in length without caudal; depth $3\frac{3}{4}$. Dorsal VII-16 or 17; anal 13; lateral line 34; eye $4\frac{1}{5}$ in head; interorbital width 7; snout 4; maxillary $2\frac{1}{2}$; height of caudal peduncle $4\frac{1}{3}$.

Body not much compressed; behind head the width is four-fifths of the depth. Snout not very steep. Mouth little oblique; the upper jaw the longer; the anterior end of the maxillary on a level with the lower margin of eye or a little below; the maxillary reaches posteriorly to below the middle of eye. Small villiform teeth in bands on jaws and vomer; none on palatines; the vomerine patch rather short and but slightly curved; the bands widened in front on jaws. Interorbital space narrow and concave. Nasal spines well developed, although scarcely protruding through skin. A moderate spine at angle of preopercle but slightly hooked; below it a smaller triangular spine; next below a very small, blunt tubercle; lower anterior edge with a small spine directed forward. A multifid superorbital flap divided to its base into 5 or 6 parts; and a similar one at posterior end of parietal region.

Skin everywhere naked; no rough plates behind axil. Lateral line a nearly straight main tube, unprotected by concealed plates, only slightly curved anteriorly, and not undulating; very short branches above and below, opposite to each other and ending in small pores.

The tip of each dorsal spine fringed with 5 or 6 tentacles. Spinous

dorsal rather low; the third spine the highest, though but little higher than the second and fourth, its length $4\frac{1}{3}$ in head. The dorsals very slightly connected at extreme base. Soft dorsal much higher than spinous; the longest rays $2\frac{1}{2}$ in head; the last ray adnate to caudal peduncle; its tip reaches well beyond that of last anal ray, but scarcely to above base of caudal rays. Anal lower than soft dorsal, its longest rays 3 in head. Pectoral with 15 rays, the longest the sixth from the top; it barely reaches past front of anal, and is equal to length of head. Ventral with a concealed spine and 3 soft rays, the middle ray the longest; the others equal; its tip does not reach quite to vent. Caudal somewhat rounded.

Color brownish on sides and upper parts, white below; 5 dark spots on back above lateral line; 1 under spinous dorsal, 3 under soft dorsal and 1 on caudal peduncle; these sometimes conspicuous, sometimes so broken up and mixed in with the general mottling of the

FIG. 28.—CROSSIAS ALLISI.

back and sides as to be obscure; dark brown of lower part of sides with many round light spots cut into it, these unpigmented or milk white; a white spot at base of middle caudal rays; obscure bars radiate from eye, 1 to each side of snout, 1 across end of maxillary, and 1 down and back across cheek; spinous dorsal irregularly mottled; soft dorsal nearly uniform light dusky showing faint traces of mottlings; each ray of anal with 5 or 6 dark conspicuous points, so wide apart as scarcely to form lines across fin, but giving fin a uniform spotted appearance; pectoral dusky above, lower rays light; a dark blotch at base of middle rays and sometimes a dark dot on base of lower rays; ventrals colorless or sometimes with faint cross lines; caudal with faint dusky, wavy cross lines.

Here described from the type and a cotype from Hakodate, 75 mm.

and 68 mm. in length. A large number of much smaller cotypes were collected at Hakodate, and a couple at Same.

The type is numbered 7711, Ichthyological Collections, Leland Stanford Junior University Museum. Cotypes are No. 50922, U.S.N.M.

(Named for Edward Phelps Allis, of Milwaukee.)

27. COTTIUSCULUS Schmidt.

Cottiusculus SCHMIDT, Manuscript (*gonez*).

This genus resembles *Gymnocanthus* in the armature of the preopercle, but has a depressed head and body; teeth on vomer and palatines; skin on head and body entirely naked; no concealed lateral line plates; no superorbital tubercles; no external intromittent organ. Ventral rays I, 3.

(Name a quasi diminutive of *Cottus*.)

a. Gill membranes forming a broad fold across the isthmus; nasal spine simple. *gonez*, 38.

aa. Gill membranes forming a narrow fold across the isthmus; nasal spine forked. *schmidti*, 39.

FIG. 29.—COTTIUSCULUS GONEZ.

38. COTTIUSCULUS GONEZ Schmidt.

Cottiusculus gonez SCHMIDT, Manuscript; Vladivostok, Aniva Bay, Sakhalin.

Head $2\frac{5}{6}$ in length without caudal; depth 5. Dorsal VII-12; anal 13; lateral line with 31 pores. Eye 4 in head; snout 4; maxillary $2\frac{1}{2}$; interorbital space 3 in eye.

Head and anterior part of body depressed; body nowhere compressed; as wide as deep posteriorly. Small villiform teeth in narrow bands on jaws, vomer, and palatines. Maxillary reaching to below anterior margin of pupil; jaws even, or the lower very slightly included. Eyes very narrowly separated; interorbital space concave. Nasal spines simple, small, and sharp, not double as in *Cottunculus*

schmidti. Spine at angle of preopercle long and rather stout; reaching beyond edge of opercle; armed above with a large anther-like process near its end and usually a very small one near its middle. Lower edge of preopercle with 3 short spines; the upper one directed backward; the middle downward and slightly forward. Large pores scattered over head and along lower edge of mandible. Branchiostegal membrane with a fold across isthmus, which is broad in comparison with that of *C. schmidti*. Body entirely naked. Lateral line pores large and conspicuous.

Pectoral with 22 rays; its tip reaches a little past front of anal, and reaching a little farther posteriorly than soft dorsal, but not nearly to caudal. Caudal slightly rounded. Ventral with 1 spine and 3 rays; the inner ray the longest, reaching three-fourths of the distance from its base to vent.

Color greyish brown on back and top of head; somewhat mottled; small irregular dark spots along side; usually the beginning of 3 cross bands on back; one under spinous dorsal, one under soft dorsal, and one on caudal peduncle; spinous dorsal with a dark edge above; rays of soft dorsal, caudal, and pectoral crossed by dusky, irregular lines; belly and under parts white; ventrals and anal white.

Here described from 5 cotypes collected by Peter Schmidt at Aneiva Bay, Saghalin. (No. 7713, Ichthyological Collections Leland Stanford Junior University.) The largest is 57 mm. in length. This species was also taken in Peter the Great Bay, near Vladivostok. We have Dr. Schmidt's kind permission to include this interesting species in the present review.

39. COTTIUSCULUS SCHMIDTI Jordan and Starks, new species.

Head $2\frac{1}{2}$ in length without caudal; depth $4\frac{1}{2}$. Dorsal VII–13; anal 12. Lateral line 27. Eye $3\frac{1}{2}$ in head; snout $3\frac{3}{4}$. Interorbital space (bone only) $\frac{1}{4}$ eye. Maxillary 3 in head; longest pectoral ray $1\frac{1}{8}$; third dorsal spine $3\frac{1}{6}$; longest dorsal rays $2\frac{2}{3}$; longest anal rays 4; length of ventrals $2\frac{1}{6}$; length of caudal $1\frac{3}{4}$; height of caudal peduncle 6.

Head and body anteriorly depressed; body growing round posteriorly, nowhere compressed. Mouth small, maxillary reaching slightly past front of eye; lower jaw included. Villiform teeth in rather narrow bands on jaws and vomer; in a very small patch on palatines. Nasal spine forked; the forks rather sharp and subequal in size. Angle of preopercle with a long, strong, slightly curved spine, which reaches beyond edge of opercle and is armed above with 2 or 3 sharp, antler-like processes; lower edge of preopercle with 3 spines, the middle one the smallest, the lowest one pointing forward, the upper one just at base of long spine, pointing backward and slightly downward. Lower corner of subopercle angulated and rather sharp.

Posterior nostril ending in a tube. Head covered with pores having raised rims. Male with a large, simple, superorbital tentacle,

which is entirely absent in the female. Interorbital space very narrow and concave.

Gill membranes connected and attached to isthmus, leaving a slight ridge, but no broad fold across isthmus, as in *Cottiusculus gonez*. Skin everywhere naked.

Pectoral with 21 rays; the sixth or seventh from the top the longest, reaching to above base of second or third anal ray. Ventrals with a concealed spine and 3 soft rays each; the inner ray the longest, reaching scarcely to vent. Soft dorsal much higher than spinous; the last ray not adnate. Tips of last anal rays reaching slightly past those of dorsal, but not to base of caudal. Caudal broadly rounded.

FIG. 30.—COTTIUSCULUS SCHMIDTI.

The above description is of a female. The male differs in having longer fin rays; some of the anterior dorsal spines filamentous and reaching past middle of base of soft dorsal; tips of last dorsal rays on the same vertical with those of anal; pectorals reaching to above fourth or fifth anal ray. No external intromittent organ.

Color brown above lateral line, slightly mottled with small irregular light spots; below lateral line white, spotted with a few brown spots following along lower edge of lateral line; no cross bars or radiating lines from eye; a dark spot on last dorsal spines; pectoral with fine spots in the female, with large spots in the male; soft dorsal with oblique cross bands, much wider and blacker in the male; caudal with 3 or 4 wavy cross bands; anal and ventrals white.

This species resembles *Cottiusculus gonez* Schmidt, but differs from it in having the nasal spine forked and in not having a broad fold across isthmus.

The type and several cotypes were dredged by the U. S. Fish Commission steamer *Albatross*, at stations 3772 and 3773, off Kinkazwan Island in Matsushima Bay. The largest is 92 mm. in length.

The type is in the U. S. National Museum and is numbered 50923. A cotype is No. 7714, Leland Stanford Junior Ichthyological Collections.

(Named for Dr. Peter Schmidt, of St. Petersburg, who collected in Japan and Siberia in 1900.)

28. ELAPHICHTHYS Jordan and Starks.

Elaphichthys JORDAN and STARKS, new genus (*elongatus*).

This genus differs from *Gymnocanthus* and *Cottiusculus* in having teeth on vomer and palatines, in having but 2 ventral rays, and in having the skin of the head smooth, not covered with rough plates as in the former genus. From *Furcina* it differs in the armature of the preopercle and in the absence of tentacles on top of head (resembling in these characters *Gymnocanthus* and *Cottiusculus*). Coasts of Japan.

(ἐλάθος, stag; ἰχθύς, fish.)

40. ELAPHICHTHYS ELONGATUS (Steindachner).

UMIKAJIKA (SEA SCULPIN).

Centridermichthys elongatus STEINDACHNER, Ich. Beitr., X, 1881, p. 86; Strielok, Japan Sea (near Vladivostok). The plate, taf. VI, fig. 2, named *Centridermichthys glaber*.—STEINDACHNER and DÖDERLEIN, Fische Japans, IV, 1887, p. 259.

Head 3 in length; depth 6. Dorsal X–17 or 18; anal 16; ventral I, 2.

Body elongate, mouth rather long; maxillary scarcely reaches to below posterior orbital rim. Jaws, vomer, and palatines with sharp teeth in bands. Eye oval; its long diameter equal to length of snout, or is contained four times in head.

Preopercle spine long, sharp, curved, and compressed, bearing on its upper edge one or two sharp processes. Top of head without tentacles. Gill membranes connected, free from isthmus.

Skin on head thin. A row of toothed plates along the lateral line and a few rough scattered plates on anterior part of body under lateral line. Skin above lateral line smooth, or thickly set with diminutive spines, as in *Trachidermus* Heckel.

Color.—Back gray-violet with dark red-violet, curved wavy, long spots, which sometimes run together; seldom dark cross bands on the lower half of body as in *Bero elegans*. (Steindachner.)

This species is not represented in our collections.

(*elongatus*, lengthened.)

29. ALCICHTHYS Jordan and Starks.

Alcichthys JORDAN and STARKS, new genus (*alcicornis*).

This genus differs from *Pseudoblennius* and *Bero* in having the large preopercular spine flat, broad, and divided into many points; and in having the cirri on top of head usually simple.

Seas of northern Japan.

(*alce*, elk; ἰχθύς, fish.)

41. ALCICHTHYS ALCICORNIS (Herzenstein).

BEROKAJIKA.

Centridermichthys alcicornis HERZENSTEIN, Zool. Mus. Kais. Akad. Wiss. St. Petersburg, XIII, 1890, p. 115; Yeso (Hokkaido).

Head $2\frac{3}{4}$ in length without caudal; depth $5\frac{1}{4}$. Dorsal X–17; anal 13; lateral line 36. Eye 6 in head; interorbital width 10; maxillary 2; snout $3\frac{1}{2}$; first dorsal spine $3\frac{1}{6}$; third dorsal spine $2\frac{1}{2}$; longest dorsal rays $2\frac{1}{3}$; longest anal rays 3; pectoral $1\frac{1}{3}$; ventral $3\frac{1}{6}$; caudal $1\frac{5}{6}$.

Head not depressed, about as wide as deep; body slender, slightly compressed posteriorly. Mouth large; lower jaw included; maxillary reaching to below posterior margin of eye. Small, sharp, conical teeth on jaws, vomer and palatines; the palatine patch about as wide as that on mandible; the vomerine patch narrower. Interorbital space

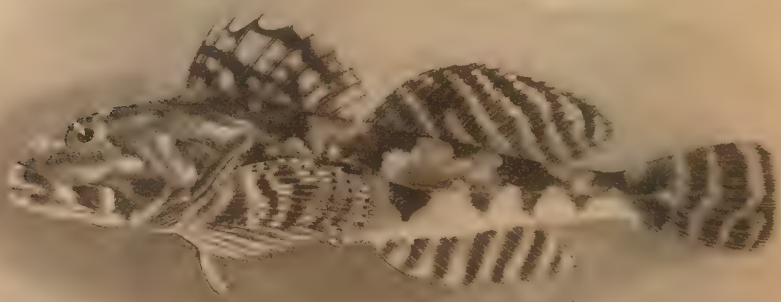

FIG. 31.—ALCICHTHYS ALCICORNIS.

moderately concave. A slight low ridge runs back from interorbital and curves outward on top of head to occiput. Processes from premaxillary strongly produced; nasal spines on each side of it well developed, triangular, not very sharp. Preopercle spine spreading out flat and wide, and divided into from 3 to 5 diverging points directed more or less upward; below it are 3 sharp points, growing larger downward, and all directed downward. Lower end of subopercle angulated and rather sharp. A wide multifid flap over posterior part of eye, a simple tentacle on middle of ridge on top of head, and a similar one at end of ridge on occiput. These are usually simple but frequently one or more of them are bifid.

Dorsals close together but not connected. Tips of spines when fin is depressed reach slightly past first dorsal ray. Tips of last dorsal rays

reach well past those of anal, but not to above base of dorsal. Pectoral with 16 rays; its tip reaching to opposite front of anal. Ventral short: once concealed spine and 2 soft rays; reaching half the distance from their base to anal papilla. Lateral line with small imbedded plates; a few scattered plates, with rough posterior edges behind axil. Skin otherwise naked and smooth.

Color light brown on back, somewhat mottled, shading lighter below to white on lower parts; spinous dorsal light; an irregular dusky blotch at each end; anal and soft dorsal crossed by oblique, dark bands, less oblique and more conspicuous on the former; pectoral with dusky cross bands and narrow white interspaces; base of caudal dusky.

Here described from a specimen 26 cm. in length, from Same in Rikuchu. Other specimens are from Hakodate.

(*alce*, elk; *cornu*, horn.)

30. FURCINA Jordan and Starks.

Furcina Jordan and Starks, new genus (*ishikawæ*).

This genus differs from *Pseudoblennius* in having 2 spines at angle of preopercle, the upper one forked; and in having a pair of very small simple cirri usually present at the nape. Ventral rays I, 2.

Small fishes of the coasts of Japan.

(*furca*, a fork.)

a Dorsal rays X–19 or 20; anal rays 17 or 18; preopercular spine narrowly forked; spinous dorsal notched ..... *ishikawæ*, 42.

aa Dorsal rays X–17 or 18; anal rays 14 or 15; preopercular spine broadly forked; spinous dorsal slightly notched ..... *osimæ*, 43.

42. FURCINA ISHIKAWÆ Jordan and Starks, new species.

Head $2\frac{5}{6}$ to $3\frac{1}{6}$ in length without caudal; depth 4. Dorsal X-19 or 20; anal 17 or 18; pores in lateral line 39; V. I, 2. Eye 4 in head; snout $3\frac{3}{4}$ to 4; maxillary $2\frac{1}{4}$ to $2\frac{1}{3}$; interorbital width 8; height of caudal peduncle 5.

Snout rather bluntly rounded and steep; jaws even, or the upper a little longer; maxillary reaching to below posterior margin of pupil. Villiform teeth on jaws, vomer and palatines; the band or premaxillary widened in front; that on mandible scarcely, or but very little widened; the palatine band short and rather wide. Interorbital narrow and moderately concave. Preorbital with 2 spines at its angle; the upper one divided at its tip and very narrowly forked; it is somewhat hooked upward; the lower one is simple, sharp, but little if any shorter, its tip directed straight backward. Anterior lower edge of preopercle with a very small blunt spine or tubercle, directed forward; posterior edge sometimes with a couple of small tubercles, sometimes smooth. Nasal spines small but sharp. A pair of multifid flaps over posterior margin of eye, and a pair of simple, or sometimes

bifid, tentacles at occipital region; a small simple tentacle sometimes presented at end of maxillary.

Lateral line forming a double curve anteriorly; each anterior pore usually with a simple tentacle. Sides under anterior part of lateral line with a few scattered rough plates; body otherwise naked.

Pectoral with 15 rays, the lower 8 swollen, the upper of which is the longest, reaching beyond the rays just above it and to above base of fourth or fifth anal ray; it is as long or sometimes exceeds the length of head. Bases of first and second dorsal spines in contact; third spine sometimes a little shorter than the first and fourth, making a shallow notch in upper outline of fin; the notch never so deep as in *F. osimæ;* usually third spine is as long or sometimes longer than first; first spine $2\frac{1}{3}$ to $2\frac{2}{3}$ in head; last spine as long as eye, and connected to soft dorsal for nearly its whole length. Soft dorsal higher than spinous, its longest rays $1\frac{5}{6}$ to $2\frac{1}{6}$ in head; posterior ray adnate

FIG. 32.—FURCINA ISHIKAWÆ.

to caudal peduncle; tips of last rays reach beyond those of anal to above base of caudal rays. Anal lower than soft dorsal, its longest rays $2\frac{1}{6}$ to $2\frac{2}{6}$ in head. Ventrals with a concealed spine and two soft rays each; the inner ray the longer, 3 in head. When the caudal is closed its posterior outline is very slightly concave; when spread it is truncate or feebly convex; its length $1\frac{1}{2}$ in head.

Color brownish above; white on belly and under parts; back with 4 cross bars; the first under middle of spinous dorsal extending forward to base of pectoral; the second under front of soft dorsal; the third under middle of soft dorsal, and the fourth under third and fourth rays from end of soft dorsal; below are a series of connected, inverted U-shaped marks, reaching above lateral line behind its curve, and connected more or less with cross bars on back; between these are smaller irregular spots mottling the sides; indefinite bars radiating from eye; a small dark spot on end of maxillary; a dark bar on base of middle

pectoral rays running backward and downward and becoming diffused toward ends of rays; a similar smaller one on lower rays; each ray of pectoral often with several small spots forming irregular cross streaks; an irregular dark blotch on first dorsal spines and one on middle spines; soft dorsal and anal with oblique dark streaks across the rays; anal sometimes uniformly dusky toward ends of rays, the tips of the rays white; caudal crossed with dark wavy streaks.

Numerous specimens taken at Myiako in Rikuchu, at Wakanoura, and at Hakodate. The type is from Myiako; it is 87 mm. in length, and is numbered 7715, Ichthyological Collections, Leland Stanford Junior University Museum. Cotypes on No. 50924, U.S.N.M.

(Named for Dr. Chiyomatsu Ishikawa.)

43. FURCINA OSIMÆ Jordan and Starks, new species.

Head 3 in length without caudal; depth 4. Dorsal X–17 or 18; anal 14 or 15; lateral line with 37 pores. V. I, 2. Eye 4 in head; interorbital width 7; snout 4; maxillary 3; height of caudal peduncle 4½.

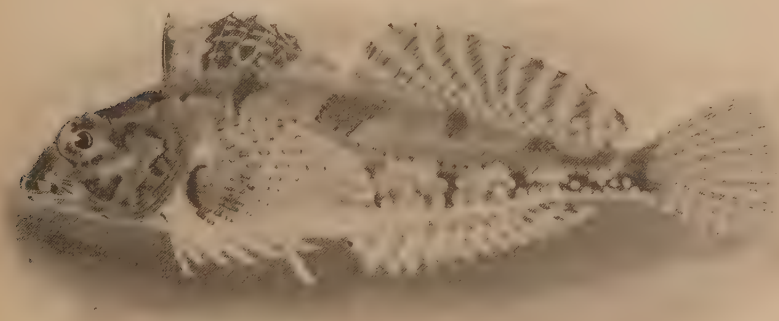

FIG. 33.—FURCINA OSIMÆ.

Lower jaw included. Mouth small, the maxillary reaching to anterior margin of pupil. Villiform teeth in bands on jaws, vomer, and palatines; the palatine band rather wide. Preopercle with 2 spines at its angle, the upper spine hooked and divided into 2 points; much more widely forked than in *F. ishikawæ;* the notch between the points rounded; the lower spine simple, much smaller, and directed straight backward. A small blunt spine under the skin on lower anterior edge of preopercle, directed forward. Posterior edge of preopercle nearly smooth, or with a couple of scarcely developed tubercles. Nasal spines well developed and sharp. The usual multifid flap present above posterior border of eye; a forked flap at posterior end of parietal region; a smaller one at nasal spines, and a smaller simple one at posterior end of maxillary.

Anterior part of lateral line double curved and sparsely fringed with small tentacles; below it and above pectoral are 1 or 2 rows of small rough plates which do not extend posterior to pectoral.

Pectoral with 14 rays, the lower 8 swollen; its tip reaches to above base of second or third anal ray. The anterior 3 dorsal spines shorter than those just behind; the third spine shorter than the first, notching the outline of the fin; first spine $3\frac{1}{3}$ in head, the third $3\frac{2}{3}$; the fourth 3. Behind the fifth the spines rapidly decrease in length; the dorsals joined at the base, but not nearly so broadly as in *F. ishikawæ*. Second dorsal higher than first; the longest rays $2\frac{1}{6}$ in head; the last ray is adnate to caudal peduncle; the tips of the last rays reach past those of anal, usually scarcely reaching to above base of caudal. Anal lower; the last ray free from caudal peduncle; the longest rays 3 in head. Caudal more rounded than in *F. ishikawæ;* the middle rays of the closed fin reaching beyond the outer rays, its length is $1\frac{2}{3}$ in head.

Color much as in *F. ishikawæ;* the cross markings the same, though more broken up, and the lower part of the sides more finely mottled; pectoral similar; spinous dorsal uniformly mottled, cross bands, soft dorsal, anal, and caudal wider and darker; the anal never uniformly dusky toward tips of rays; the branchiostegal rays usually strikingly marked with a streak of milk white along each ray, in strong contrast with the unpigmented breast; a small area in front of them white; the membrane between each ray is often black.

This species may be at once known from *F. ishikawæ* by the fewer fin rays, the more widely forked preopercular spine, and by the deeper notch in spinous dorsal. Of the 10 specimens of this species and 30 or 40 of *F. ishikawæ* that were examined, no variation of fin rays was found outside of the limits here given.

This species is probably less common than *F. ishikawæ*. Specimens were taken at Hakodate and Misaki. The type is from the former place; it is 77 mm. in length and is numbered 7716, Ichthyological Collections, Leland Stanford Junior University Museum. A cotype is No. 50925, U.S.N.M.

(From *Oshima*, great island, the province of Hokkaido, of which Hakodate is the capital.)

31. OCYNECTES Jordan and Starks.

Ocynectes Jordan and Starks, new genus (*maschalis*).

This genus is closely related to *Bero*, but differs particularly in the character of the lateral line, which is not undulating anteriorly and is not protected by concealed plates, but usually has a small tentacle at each pore. The pectorals are very large, half the length of body without head, or exceeding the length of head.

This genus resembles *Blennicottus* of the California coast, but it has only two ventral rays, as do all of the Japanese genera that closely center about *Pseudoblennius*.

Small fishes of the Japanese rock pools.

(ὀκύς, swift; νεκτής, swimmer.)

44. OCYNECTES MASCHALIS Jordan and Starks, new species.

Head $3\frac{3}{8}$ in length without caudal; depth $4\frac{1}{2}$ to $4\frac{4}{5}$. Dorsal IX–13 or 14; anal 10; lateral line pores 34. Eye $4\frac{1}{2}$ in head; snout $3\frac{3}{4}$, maxillary $2\frac{3}{5}$; height of caudal peduncle $3\frac{1}{4}$. Bony interorbital width half eye.

Profile of head very slightly convex and gently sloping to snout; snout steep; lower jaw included. Mouth small, little oblique, anterior end of maxillary well below level of eye; maxillary reaching posteriorly to below middle of eye. Interorbital space narrow and deeply

FIG. 34.—OCYNECTES MASCHALIS.

concave. Teeth fine villiform, in bands on jaws, vomer, and palatines; the premaxillary band much widened in front, that on mandible but little widened; the palatine patch rather broad and short. Top of head with 3 pairs of multifid flaps; the first pair over posterior orbital rim; the posterior pair at occipital region; the middle pair closer to each other than the others are, and closer to the posterior pair than to the orbital pair. Head otherwise without tentacles. Nasal spines prominent; the hooked spine at angle of preopercle is rather small and blunt, its tip not projecting through skin; below it on edge of preopercle are a couple of blunt, bony tubercles.

Lateral line curved up anteriorly, but not undulating in species of *Pseudoblennius* and *Bero*; anteriorly each pore usually bears a small tentacle. Skin everywhere naked.

Pectoral with 15 simple rays, the lower 8 swollen; the upper swollen ray much longer than any of the others; the rays rapidly becoming

shorter above and below it; the fin very large and sharply pointed behind, reaching to above base of second of third anal ray; its greatest length $2\frac{4}{5}$ in length without caudal. Ventrals short, with a concealed spine and 2 soft rays, the inner ray the longer, scarcely reaching to vent; their length $2\frac{1}{6}$ in head. Spinous dorsal low and long, rounded at each end, very gently rounded above, nearly level; spines scarcely varying in length from third to seventh, their length $3\frac{3}{5}$ in head. Dorsals barely separated. Soft dorsal much higher than spinous; the highest rays just behind the third or fourth; their length $2\frac{1}{2}$ of head; last ray adnate to caudal peduncle; the tips of last rays about on a vertical with those of anal, and ending in front of base of caudal a distance equal to diameter of eye. Caudal truncate, the outer angles very slightly rounded, its length $1\frac{2}{5}$ in head. Longest anal rays near posterior end of fin, their length $2\frac{1}{4}$ in head, the last ray free from caudal peduncle.

Color slaty brown on back and sides, mottled with darker; 5 irregular blotches on back above lateral line, 2 under each dorsal, and one across caudal peduncle; a dark crossbar at base of caudal; a dark spot at posterior end of spinous dorsal; the fin mottled with dusky, growing dark toward edge, and narrowly bordered with white; the rays of pectoral and caudal crossed with dusky irregular bands, the color not involving the membrane; the soft dorsal with oblique, dusky bands running back and down across rays, sometimes on membrane, sometimes on rays only; a few dark dots on rays of anal, but so sparse as to scarcely indicate bands; ventrals colorless; a single conspicuous black dot always present on axil; underpart of head creamy white in contrast with the unpigmented underparts of body.

A few specimens taken at Enoshima, and 2, one of them the type, taken at Wakanoura. The type is 55 mm. in length; the others do not exceed that length.

The type is numbered 7717, Leland Stanford Junior University Museum. Cotypes are No. 50926, U.S.N.M.

(*μαοχάλη*, the armpit.)

32. PSEUDOBLENNIUS Schlegel.

Pseudoblennius SCHLEGEL, Fauna Japonica, 1850, p. 313 (*percoides*).
Pseudoclinus SCHLEGEL, Fauna Japonica, pl. LXXIX *a*, same type.

Body and head compressed; skin naked, or with a few scattered small plates under pectoral; preopercle with a single hooked spine at angle; gill membrane connected, but free from isthmus; small sharp teeth in bands on jaws, vomer, and palatines; mouth large; a tentacle above eye; no slit behind last gill arch; branchiostegals 6; dorsal with about 10 spines, separated from the soft portion or connected at extreme end only; pectoral rays all simple, the lower ones swollen; ventrals very small, a concealed spine, and 2 soft rays; copulating

organ of male large and trilobate at its end;[a] lateral line forming a double curve anteriorly. Coasts of Japan.

(ψευδής, false; *blennius*, the form and bright coloration resembling that of some clinoid blennies.)

a Edge of spinous dorsal even and entire, without a notch.
  b Teeth sharp and conical; small nasal spines present.
    c Maxillary reaching slightly beyond eye; snout long and sharp...*percoides*, 45.
    cc Maxillary not reaching beyond eye; snout shorter and blunter...*cottoides*, 46.
  bb Teeth villiform; nasal spines obsolete.....*zonostigma*, 47.
aa Spinous dorsal with a notch above.
    d Anterior dorsal spines elevated; dorsal IX–20; anal, 17.....*marmoratus*, 48.
    dd Anterior dorsal spines not elevated; dorsal IX–16; anal, 13....*totomius*, 49.

45. PSEUDOBLENNIUS PERCOIDES Günther.

ANAHAZE[b] (ROCK POOL GOBY); YANAGI HAZE (WILLOW GOBY).

Pseudoblennius SCHLEGEL, Fauna Japonica, Poiss., 1850, p. 313, pl. LXXIX*a*, figs. 2, 3, called *Pseudoclinus;* Omura, near Nagasaki.

Pseudoblennius percoides GÜNTHER Cat. Fish, II, 1860, p. 297, after Schlegel.

Centridermichthys percoides STEINDACHNER and DÖDERLEIN, Fische Japans, III, 1884, p. 209; Tokyo.—ISHIKAWA, Prel. Cat., 1897, p. 48; Hokkaido, Boshu.

Psudoblennius anahaze BLEEKER, Poissons Connues du Japon, 1879, p. 11, after Schlegel.

Centridermichthys schlegeli DÖDERLEIN, Fische Japans, III, 1884, p. 210; Tokyo.

Centridermichthys argenteus DÖDERLEIN, Fische Japans, IV, 1887, p. 257; Tokyo.

Head $2\frac{2}{3}$ to $2\frac{3}{4}$ in length without caudal; depth $4\frac{1}{2}$. Dorsal X-18; anal 17; pores of lateral line 36. Eye $5\frac{1}{2}$ in head; interorbital space 8; snout $3\frac{1}{4}$; maxillary 2; height of caudal peduncle 4. Upper profile of head rather evenly and gently curved to tip of snout; the premaxillary processes very slightly produced, making a small blunt angle behind middle of snout. Mouth large; the maxillary terminating just past posterior border of eye. Lower jaw included. Small sharp, conic, depressible teeth in bands on jaws, vomer, and palatines; those on palatines much smaller than elsewhere; the bands on premaxillaries very much widened in front, on mandible only a little widened; the

[a] Mr. Michitaro Sindo has examined the reproductive organs of this genus and reports as follows: "The copulatory organ of the male is placed immediately behind the vent. It is a long, large, rod-like external process, divided at the end into two lateral knob-like processes and one slender posterior process, which is hooked anteriorly between the lateral ones. The posterior process arises from a firm round body embedded at the root of the lateral papillæ within a membranous fold, and distally terminates in a glandular sac. The seminal duct pierces through the rod and bifurcate laterally beneath the root of the posterior process, each branch opening externally at the end of the lateral papilla. In the female the oviduct forms a thick walled muscular vestibule which is lobulated and opens to the exterior just behind a rather firm dermal papilla, immediately behind the vent. The cloacal opening thus formed is in the resting stage, and is covered over by a thin membrane. The proximal end of the vestibule is divided into two muscular horns which are prolonged into the anterodorsal part of the body cavity and come into relation with the ovary of each side. The impregnation is evidently intrauterine, the eggs developing in the uterine horns."

[b] *Ana*, means crevice; *haze*, goby.

vomer projects conspicuously below the level of the palatines. Interorbital width two-fifths of length of orbit; it is slightly and evenly concave, and with a small median canal which is not evident until the skin is pressed into it. Superorbital tentacle thin and flat, about as long as pupil; a very small nasal tentacle present. Snout long, narrow, and rather sharp, $1\frac{1}{2}$ or $1\frac{3}{5}$ in postorbital part of head. A small sharp spine at edge of preopercle opposite end of suborbital stay; below it edge of preopercle is apparently smooth, though at anterior lower edge under the skin there is a small tubercle of bone hooked downward, with usually a smaller one above it, nasal spines very small but evident. Skin everywhere smooth.

Pectoral reaches to front of anal; it has 15 simple rays, the ninth from the top the longest, $1\frac{3}{5}$ in head, the lower 7 rays swollen; the rays above the longest are truncated slightly obliquely, those below decrease rapidly in length. Ventrals with 2 rays, the inner slightly the longer; they reach half of the distance between their base and vent. Spinous dorsal rather low, rounded posteriorly, level and straight above, not elevated anteriorly, the first spine but little shorter than the second, which equals in length 4 or 5 spines behind it, 3 to $3\frac{1}{2}$ in head. Soft dorsal higher than spinous, the highest rays $2\frac{3}{5}$ to 3 in head. Third anal ray $3\frac{1}{2}$ in head. Caudal truncate or slightly rounded, its length $1\frac{5}{6}$ to 2 in head.

Color in spirits brown above, lighter below, back and sides with 6 usually inconspicuous blended crossbars, broken at lateral line; sometimes below lateral line alternating with those above; 2 under spinous dorsal, 3 under soft dorsal, and 1 at caudal peduncle; a dark bar present across nape, a dark irregular streak backwards from eye, and a row of 5 or 6 dark spots across maxillary and cheek below suborbital stay. All of the above bars sometimes very conspicuous, very inconspicuous or entirely absent. Sides usually with many small round dark spots, which are ringed with white where they cut into the dark crossbars; sides of head on some specimens with reticulated dark lines; dorsal spines dark, 4 or 5 with a dark blotch across membrane, behind them membrane is transparent, but edged above and behind with dark; soft dorsal usually uniformly dark, but sometimes with faint light lines across rays; anal sometimes white, pectoral with dark blotch on base of middle rays and a smaller one on lower 1 or 2 rays; a dark spot just at base of upper ray; a row of dark spots ocellated with white along upper and lower edges of caudal. In life, the ground color is subject to variations, usually olive brown; it is sometimes green and often red.

Here described from specimens from 13 to 18 cm. in length. Specimens were taken at Tokyo, Matsushima, Misaki, Wakanoura, Nagasaki, Hiroshima, and Tsuruga. It is one of the commonest fishes of the coast of Japan, daily in the markets, but little valued as food.

(*πέρκη*, perch; *εἶδως*, likness.)

46. PSEUDOBLENNIUS COTTOIDES (Richardson).

Podabrus cottoides RICHARDSON, Voy. Samarang, Fishes, p. 13, pl. I, figs. 1–6. (Sea of China).—GÜNTHER, Cat. Fish, II, 1860, p. 152; same specimens.

Centridermichthys japonicus STEINDACHNER, Ichth. Beitr., X, 1881, p. 187; Kanagawa, near Yokohama, Japan.—STEINDACHNER and DÖDERLEIN, Fische Japans, IV, 1887, p. 259.

Centridermichthys affinis, STEINDACHNER and DÖDERLEIN, Fische Japans, IV, 1887, p. 257; Tango, Kanagawa.

Head $2\frac{4}{5}$ to 3 in length without caudal; depth $4\frac{1}{4}$ to $4\frac{1}{2}$. Dorsal X–19 or 20; anal 17 or 18; pores in lateral line 42. Eye $4\frac{1}{2}$ to 5 in head (4 in specimens 8 cm. long); interorbital space $7\frac{1}{2}$ to 8; snout $3\frac{1}{2}$ to $3\frac{3}{4}$; maxillary $2\frac{1}{4}$; height of caudle peduncle 5.

Shape of head and body much as in *P. percoides;* the snout shorter, the body tapering into a more slender, less compressed caudal peduncle. Mouth rather large, the maxillary usually scarcely reaching to posterior border of eye. Lower jaw included. Teeth as in *P. percoides.* Interorbital space with a narrow canal, hidden by the skin. Superorbital tentacle flat; its length usually exceeding that of pupil; a small nasal tentacle present. Snout longer than eye by about half the diameter of the latter, $1\frac{2}{3}$ to 2 in postorbital part of the head. Preopercle with a small, sharp, hooked spine at its edge opposite end of suborbital stay and a very small spine hooked forward at its lower anterior edge, completely covered by the skin. Nasal spines present, but very small. A few small, rough, bony plates beneath and just above pectoral. Skin otherwise perfectly smooth.

Pectoral rays all simple, tip of fin reaching to front of anal; its length $1\frac{2}{5}$ in head. Ventrals with 2 rays; their length 4 in head. First and second spines of dorsal equal in length and slightly higher than other spines, their length 3 in head; spinous dorsal rounded posteriorly. Caudal very slightly concave, its length $1\frac{4}{5}$ in head.

Color brown on back, lighter below, belly and lower parts white; sides with 6 rather conspicuous dark cross bars; usually there are 2 rows of clear cut white spots, somewhat larger than pupil along the sides below the lateral line; many of the spots in the upper row run together, those in the lower row frequently half spots or running into the white of lower parts; lateral line running through a light streak; on its upper edge are conspicuous small, dark, brown spots irregularly placed; 2 or 3 dark spots below eye on cheek, 1 maxillary under front of eye; chin with dark spots around its edge; snout dark; spinous dorsal transparent behind second or third spine, bordered above and behind with dusky; anal and soft dorsal white with 5 or 6 black dots on each ray forming lines of dots obliquely across the fin running backward and upward toward the body; membrane transparent; pectoral rays with similar spots, the lower rays white; a dark spot at base of middle rays and a similar smaller one on lower rays;

caudal dusky, the upper and lower rays with 4 or 5 half-round spots open outward; each of the rays between with smaller white spots.

This species may be known from *P. percoides* by the shorter maxillary, the narrower caudal peduncle, the shorter snout, and by the color. It is here described from specimens from 12 to 15 cm. in length. Specimens were taken in abundance at Misaki, Matsushima, Onomichi, Aomori, Enoshima, Yokohama, Tokyo, Tsuruga, and Hakodate. The species is scarcely less common than *Pseudoblennius percoides*. There can be no doubt of the identity of *P. cottoides*, *japonicus*, and *affinis*.

(*cottus*, sculpin; εἶδος, resemblance.)

47. PSEUDOBLENNIUS ZONOSTIGMA Jordan and Starks, new species.

Head $2\frac{3}{5}$ in length without caudal; depth 4. Dorsal X–19; anal 17; pores in lateral line 39. Eye $4\frac{1}{2}$ to 5 in head; interorbital space 6, bone only 9; snout $3\frac{1}{2}$; maxillary 2; height of caudal peduncle $4\frac{1}{2}$.

Head rather large; body deepest under middle of spinous dorsal, tapering into a moderately deep caudal peduncle. Mouth large, a little oblique, the maxillary reaching to below posterior orbital margin. Lower jaw scarcely as long as upper. Teeth villiform, finer than in any other Japanese member of the genus except *P. totomius*, in narrow bands on jaws, vomer, and palatines; the palatine patch very narrow. Interorbital space rather wide and shallow. A small sharp spine at angle of preopercle, hooked upward, its posterior edge scarcely forming an angle with edge of preopercle; a very small spine directed downward at anterior lower edge of preopercle; otherwise edge of preopercle is even and smooth. Nasal spine obsolete.

A small flat superorbital tentacle and a very small nasal tentacle present; anterior nasal ending in a tube. Skin everywhere smooth and naked; no plates under anterior part of lateral line.

Pectoral with 15 rays, the lower 8 swollen, the uppermost of which is the longest, reaching a little past front of anal and is equal to two-thirds the length of the head. Length of ventrals 4 in head. Spinous dorsal rather high and evenly rounded; the third spine $2\frac{3}{4}$ in head; it is entirely separated from soft dorsal; interval between equal to the space between soft rays at base. The soft dorsal only a little higher than spinous, the longest rays $2\frac{1}{2}$ in head; the last ray is not connected by membrane to caudal peduncle; the tips of the last rays reach to opposite those of anal and end at a distance from base of median caudal rays equal to the diameter of iris. Longest anal rays equal to those of soft dorsal. Caudal truncate, or very slightly convex when fin is spread.

Color dark brown on top of head and back, shading gradually downward to the white of lower parts; body entirely crossed by 6 double rows of small brown spots, about as large as pupil, these somewhat broken at lateral line and not arranged so regularly on back as below;

in the type specimen they are somewhat run together, forming double cross-streaks with uneven edges; a pair of rows across caudal peduncle, 3 pairs under soft dorsal, and 2 pairs under spinous dorsal; chin and snout dark; sometimes there is a dark band from eye along each side of snout and across chin; a dark spot on maxillary below eye; traces of a dark streak running back from eye to edge of opercle; a small dark spot on base of middle pectoral rays, sometimes shading downward and growing wider on lower rays; spinous dorsal with a jet-black spot on first and last spines; the fin bordered with dusky; soft dorsal with wavy dark stripes running backwards and downwards obliquely across the rays, these involving the membrane more than the ray; anal obliquely marked with broader bands which spring from the termination of the double body stripes at base of fin but run together toward edge of fin; caudal irregularly dusky; ventrals white.

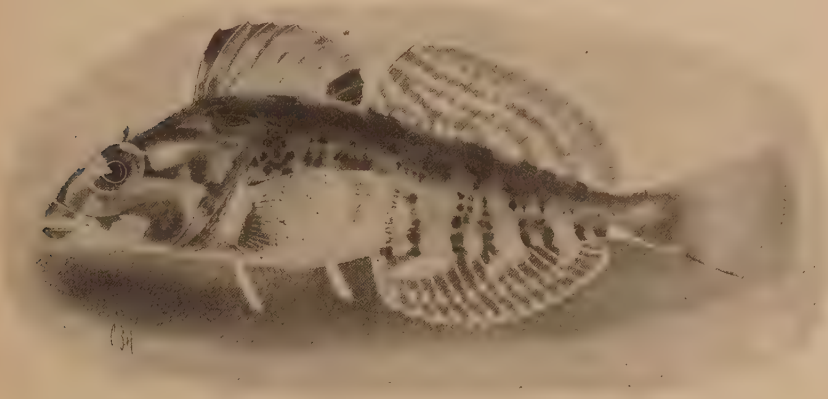

FIG. 35.—PSEUDOBLENNIUS ZONOSTIGMA.

This species may be separated from the other known Japanese species *Pseudoblennius* by the color markings; from *P. percoides* and *P. japonicus* by the finer teeth and lack of nasal spines; from *P. marmoratus* by the wider caudal peduncle and by the spinous dorsal.

Two specimens were taken at Nagasaki, and one, the type, from Misaki. The type is 105 mm. in length; the larger of the cotypes is 120 mm.

The type is numbered 7718, Ichthyological Collections, Leland Stanford Junior University Museum. A cotype is No. 50927, U.S.N.M.

(ζονός, band; στίγμα, spot.)

48. PSEUDOBLENNIUS MARMORATUS (Döderlein.)

Centridermichthys marmoratus DÖDERLEIN, Fische Japans, III, 1884, p. 210; Tokyo.—STEINDACHNER, Fische Japans, IV, 1887, p. 259.

Head 3 in length, without caudal; depth $4\frac{1}{3}$. Dorsal IX–20; anal 17; pores of lateral line 37. Eye 5 in head; interorbital space $7\frac{1}{2}$, bone only 12; snout $3\frac{3}{4}$; maxillary $2\frac{1}{4}$; height of caudal peduncle $5\frac{2}{3}$.

Lower jaw included, snout $1\frac{1}{3}$ to $1\frac{1}{2}$ times longer than eye; maxillary reaching to behind pupil, scarcely to posterior border of orbit. Small, conical, sharp teeth in narrow bands on jaws, vomer, and palatines, smaller than in *P. japonicus* or *P. percoides;* the premaxillary band not so much widened in front; slightly than the bands on mandible; teeth on vomer and palatines equal in size; the vomer projects below the level of the palatines. Preopercle with a small sharp spine at angle, a very small, blunt, antrorse spine, covered by the skin, at lower anterior edge, and a couple of slight scollops on posterior edge. Nasal spines obsolete. Superorbital tentacle small and flat, shorter than pupil; small nasal tentacles present. Interorbital space rather narrow and deep.

Spinous dorsal elevated in front and with a rounded notch at its middle; the first and second spines much closer together at their base than are the others, the latter higher than the other spines, its length $2\frac{2}{3}$ in head, the first, the next highest, only slightly higher than the third, $3\frac{1}{6}$; the fourth much shorter, $3\frac{5}{6}$; the fifth and sixth slightly higher; the fin rounded behind. The soft dorsal higher than the spinous, the longest rays $2\frac{2}{5}$ in head; the last ray is connected to caudal peduncle by a membrane; the tips of the last ray reach slightly past those of anal. Anal much lower than soft dorsal, the longest rays $3\frac{2}{5}$ in head. Pectoral with 13 rays, the lower 8 swollen, the uppermost of which is the longest, and reaches a little past front of anal, its length $1\frac{1}{4}$ in head. Caudal rounded, its length $1\frac{4}{5}$ in head Lateral line with a strong double curve anteriorly, stronger than in other species. A row of small bony plates sometimes present above pectoral; skin otherwise naked.

Color.—Brown above, belly and under parts white; back above lateral line with dark cross bands; the first at front of spinous dorsal; the second just behind middle of spinous dorsal, the third under front of soft dorsal, the fourth under middle of soft dorsal, the fifth under sixteenth to eighteenth rays on the caudal peduncle; the sides below lateral lines mottled with irregular dark blotches; a dark band running anteriorly from nape through eye across maxillary, involving the iris; a dark band less conspicuous and more broken, running from eye backward across cheek following upper edge of suborbital stay; spinous dorsal dusky except on area at center, which is transparent; soft dorsal and anal with 6 to 7 dark cross bands running obliquely across rays from their tips slightly backward and upward toward

body, those on anal more conspicuous and regular; caudal dusky, outer rays with 3 white spots, inner rays with smaller, less conspicuous spots; a dusky blotch at base of middle pectoral rays, and a smaller one at lower rays; behind these are three or four dusky bars across the rays; ventrals white or sometimes with a dusky spot on their anterior half; all dark markings on body have a purplish or violet cast. Another specimen is much darker; the head is dark, with sharp-cut, irregular blotches separated by light lines; the bars across soft dorsal are broken up into many black streaks, and the bars on anal run together chain-like; the other fins are marked as before described, but the dusky is here black, making the contrast with the light much greater; the sides are very dark mottled with sharp-cut, irregular, and round white spots; chin and branchiostegals with round white spots.

This species may be known by the elevated first dorsal spine, the round notch in the spinous dorsal behind them, and by the slender caudal peduncle. It is evidently not so common as *P. percoides* and *P. japonicus*. Specimens were taken at Misaki and Enoshima. The longest 15 cm. in length.

(*marmoratus*, marbled.)

49. PSEUDOBLENNIUS TOTOMIUS Jordan and Starks, new species.

Head $2\frac{3}{4}$ in length without caudal; depth 4. Dorsal IX–16; anal 13; lateral line pores 37. Eye 4 in head; interorbital width 9, bony part only 12; snout $3\frac{1}{2}$; maxillary $2\frac{3}{8}$; height of caudal peduncle $5\frac{3}{4}$.

Jaws even. Mouth low, little oblique. Maxillary scarcely reaching to below middle of eye; its anterior end a little below the level of eye. Villiform teeth on jaws, vomer, and palatines, the bands on front of premaxillaries wider than elsewhere; the bands on vomer and palatines about equal in width. Interorbital narrower and concave, without a median channel. A sharp, strongly hooked spine at angle of preopercle, and a smaller one at lower anterior edge, directed forward, edge of preopercle between spines smooth and even. Nasal spines well developed. Superocular tentacle present.

Pectoral with 14 rays, the lower 7 swollen, the upper swollen ray projecting slightly beyond the others; reaching to above second anal ray; its length $1\frac{1}{3}$ in head. Ventrals with 2 rays, the inner the longer, reaching two-fifths of the distance from their base to front of anal. The first 3 dorsal spines slightly separated from the others by a very shallow notch; the first and fourth subequal, $2\frac{3}{4}$ in head, the second and third gradually and slightly shortened. The dorsals separated by an interval equal to the space between dorsal rays at base. The soft dorsal higher than spinous, the longest rays $2\frac{2}{5}$ in head; the last ray is free from the caudal peduncle; the tips of the last rays do not nearly reach to the base of the caudal rays, but project slightly beyond those of anal. Anal lower than soft dorsal, its longest rays 3 in head.

Caudal rounded, its length $1\frac{3}{4}$ in head. Skin, under a strong lens, appears rough with very small papillæ, but smooth to the touch; to the naked eye, when specimen is dry on the surface, not appearing smooth and polished as in other members of the genus. The concealed lateral line plates smooth, but well developed.

Color.—Brown on back and sides; under parts white; 5 large dark brown spots on back above lateral line, the posterior 3 widely forked below and each fork terminating at lateral line in a conspicuous small dark-brown spot; the forking of the spots rather obscure; no color on lateral line; below lateral line there is a fringe of 7 or 8 triangular brown marks extending the whole length of body, their apex downward, their bases connected, the posterior 5 or 6 end below in a small, round, conspicuous brown spot above anal fin; a dark bar from eye

FIG. 36.—PSEUDOBLENNIUS TOTOMIUS.

running anteriorly to each side of snout across maxillary and forming a small spot on each side of chin; another streak from eye across posterior end of maxillary; a dark blotch on cheek below eye; a dark blotch on first 3 dorsal spines, a light dusky spot on last spines; a faint dusky spot at base of middle pectoral rays; pectoral otherwise colorless; other fins all colorless; soft dorsal showing the faintest trace of dusky markings scarcely to be made out. The body is nowhere mottled with irregular spots.

This species may be known by its short dorsal and anal, its shallow notch in dorsal, its small mouth, and by its color.

The single specimen is a female 72 mm. in length, and was dredged by the U. S. Fish Commission steamer *Albatross*, off Omi Saki (Point), in Totomi Bay, Japan, in 34 fathoms of water. Station 3729.

The type is numbered 50928, U.S.N M.

33. BERO Jordan and Starks.

Bero JORDAN and STARKS, new genus (*elegans*).

This genus differs from *Pseudoblennius* in having the form of the body wider, not compressed, in having 3 pairs of multifid flaps on top of head, and also in having the anal papilla or intromittent organ simple and tapering, not trilobate and cylindrical as in typical species of *Pseudoblennius*.

(*bero*, vernacular name of *Bero elegans* at Aomori. In southern Japan, *bero* means tongue.)

50. BERO ELEGANS (Steindachner).

BERO.

Centridermichthys elegans STEINDACHNER, Ich. Beiträge, X., 1881, p. 7; Strielok, near Vladivostok, Japan Sea.

Head $2\frac{3}{4}$ in length without caudal; depth $3\frac{4}{5}$. Dorsal X–16; anal 14; lateral line with 37 pores. Eye 5 in head; interorbital space 8; snout 4; maxillary 2; height of caudal peduncle 4 to $4\frac{1}{2}$.

Body anteriorly as wide as deep; head wider than deep. Nape slightly produced above occipital region; a conspicuous notch in profile in front of eyes, formed by the produced nasal spines. Mouth large; maxillary reaching to below posterior rim of orbit. Teeth villiform, in rather narrow bands in jaws, vomer, and palatines. Preopercle with a strongly hooked sharp spine at angle, an anteriorly directed spine at lower anterior edge, and a couple of slight bony tubercles on edge between spines. Nasal spines large and rather sharp, though their tips scarcely project through the skin. Top of head with 3 pairs of multifid flaps; the first over posterior border of eye, a little larger and usually more divided than the others; the other 2 pairs (occasionally 3 pairs) behind and in a line with the superorbital pair, the last at occiput; very rarely some of the posterior flaps are simple. A small simple tentacle on front of nasal spine near tip; a similar one at end of maxillary; 2 or 3 very small ones on edge of preopercle below hooked spine. Lateral line with small concealed plates, the posterior edges of the anterior ones free and rough; behind base of pectoral and just above pectoral are usually 2 or 3 short straight rows of similar rough plates; the upper row the longest; not extending past tip of pectoral.

Pectoral with 15 simple rays; the lower 9 swollen; the upper swollen one the longest, reaching to opposite front of anal; its length $1\frac{1}{4}$ in head. Spinous dorsal rather low and evenly rounded; the fourth spine the highest, $2\frac{5}{6}$ in head. Soft dorsal higher, the longest rays $2\frac{1}{3}$ in head; the last ray is free from caudal peduncle; tips of last rays not reaching to base of auxiliary caudal rays. Anal equal in height to spinous dorsal; its origin under that of soft dorsal; its termination

(at base) in front of that of dorsal a distance equal to diameter of eye. Caudal rounded, its length $1\frac{4}{5}$ in head.

Color.—Back and sides mottled dusky or brown, growing lighter below; white on belly and under parts; 6 quadrate, clear-cut black blotches on back; the anterior 4 reach little over halfway from dorsal to lateral line; 2 under soft (the first obscure); 3 under soft dorsal, and one on caudal peduncle; below lateral line these markings are repeated, though they are usually out of line with those above; spinous dorsal slightly and irregularly mottled; soft dorsal with 6 or 7 very irregular crossbars running back and down obliquely across the rays to body; anal with 7 or 8 similarly placed bars, but more conspicuous and regular in outline and position; pectoral with irregular dusky bars, following somewhat the contour of the fin; caudal dusky and crossed with 4 or 5 irregular white bars; across tips of rays is a more regular white bar, bordered on each side with black.

FIG. 37.—BERO ELEGANS.

The following color note is taken from a fresh specimen: Light brownish cherry red; highly mottled with dusky shades and round spots of whitish; the spots smaller on head; fins with blackish and paler orange and whitish cross bands; pectoral and caudal brighter than other fins; ventrals pale.

Numerous specimens were taken at Tokyo, Aomori, Kitami, and Hakodate, the longest 15 cm. in length. In life it is one of the handsomest of the Cottidæ. It is especially abundant about Aomori, in the straits of Tsugaru.

(*elegans*, neat.)

34. VELLITOR Jordan and Starks.

Podabrus RICHARDSON, Voyage of the Samarang, Fishes, 1850, p. 11 (*centropomus*); name preoccupied by *Podabrus* Fischer, a genus of beetles.

Vellitor JORDAN and STARKS, new genus (*centropomus*).

This genus is characterized by the long pike-like head, suggesting the genus *Centropomus*, the profile sloping straight or slightly concave above to the tip of the long, sharp snout; the deep compressed

body, tapering to a very slender caudal peduncle; the fins high, and with slender rays; the first spine of dorsal produced, the middle spines very long, rapidly diminishing in length before and behind; the caudal long and conspicuously forked; the preopercular spine very short, sharp, and straight, not hooked; the palatines with a narrow band of teeth at their posterior end, remote from the vomer; the flat or slightly convex interorbital space; the lateral line without concealed plates; the head without tentacles.

Otherwise it resembles *Pseudoblennius*. Gill membranes connected, free from isthmus; no slit behind last gill arch; pectoral rays simple; ventrals very small, each with one concealed spine and two soft rays; lateral line undulating anteriorly; copulating organ of male constructed as in *Pseudoblennius*, though less conspicuously trilobate at its termination.

(*vellitor*, one who plucks or tears.)

51. VELLITOR CENTROPOMUS (Richardson).

SUI.

Podabrus centropomus RICHARDSON, Voyage of the Samarang, Fishes, 1850, p. 11, pl. I, figs. 7–11; Quelpart, Straits of Korea.—GÜNTHER, Cat. Fish., II, 1860, p. 152 (copied).

Centridermichthys nudus DÖDERLEIN, Fische Japans, IV, 1887, p. 258; Bay of Tokyo.—ISHIKAWA, Prel. Cat., 1897, p. 48; Boshu.

Head $2\frac{3}{5}$ in length without caudal; depth 4. Dorsal X–20; anal 19; lateral line 41 pores. Eye 5 in head; interorbital width $6\frac{1}{2}$; snout $2\frac{3}{4}$; maxillary $2\frac{1}{2}$; height of caudal peduncle $6\frac{1}{2}$.

Body strongly compressed and somewhat elevated, highest under spinous dorsal; from first dorsal spine to tip of snout the upper profile is slightly concave and gently sloping; from chin to anal the lower profile is nearly straight and more nearly horizontal than above; posteriorly the body tapers into a slender caudal peduncle. Snout long and sharply pointed, as viewed laterally. Lower jaw strongly projecting. Mouth rather large, little oblique, the maxillary reaching to just past front of orbit. Teeth villiform, small, but rather sharp; the bands on jaws widened in front, slightly wider on upper jaw; the palatine with a narrow band on its posterior end remote from the vomerine patch, which is U-shaped. Preopercle with a short, sharp spine at angle, usually straight and directed nearly straight backward or very slightly upward, sometimes slightly curved, never hooked as in related forms; no secondary spines below this. Head otherwise without spines or tentacles.

Dorsal spines very slender and flexible; the first produced, usually longer than the other spines, though sometimes a little shorter; the second spine usually shorter than third, forming a notch at the fin; the middle spines very high, the fifth the highest, $1\frac{2}{3}$ to 2 in head; the spines behind it rapidly shortened to the last, which is half the

diameter of the eye; the posterior outline of the fin slightly concave; the second spine $2\frac{1}{4}$ to $2\frac{1}{2}$ in head; behind it the spines gradually lengthened to the highest. Soft dorsal and anal similar in form and height, beginning and ending opposite to each other; the highest rays $2\frac{1}{2}$ in head; the last rays not adnate to caudal peduncle; their tips not reaching to base of caudal rays. The caudal rays are the only divided rays; they are divided once and are widely forked; caudal fin forked, or very deeply concave when fin is spread; the longest rays $1\frac{1}{4}$ to $1\frac{1}{2}$ in head, the middle rays $1\frac{3}{8}$ to 2. Ventral with 1 concealed spine and 2 soft rays; its tip does not reach vent; its length 4 in head. Pectoral with 14 rays; the lower 5 slightly swollen; tip of fin reaches to above base of second or third anal ray, its length $1\frac{3}{8}$ in head.

Color nearly uniform dark brown above, olive green in life, shading lighter below, green shaded in life; belly white; occasionally back and sides are mottled with an irregular network of dark-brown lines;

FIG. 38.—VELLITOR CENTROPOMUS.

one or two of the mottled specimens show a couple of white vertical spots on side under posterior third of pectoral; lips dark; under parts of head white; spinous dorsal dusky, sometimes showing traces of darker irregular lines obliquely across spines; usually there is a transparent spot at base of last 2 spines; soft dorsal and anal uniform dusky, and without markings; pectoral colorless or slightly dusky; ventrals white; caudal dusky, crossed with several irregular darker lines, sometimes uniform dusky. We note that in the specimens most mottled, as is the case with the one figured, the caudal is plain. In the specimens which are plain olive the caudal is usually faintly barred with dark. These differences may be sexual.

Numerous specimens were taken at Misaki, in the shallow bays near the shore. The largest is 12 cm. in length. A specimen was also sent by Mr. Otaki from the market of Tokyo.

(*centropomus*, the Robalo, from the likeness in form as seen from the side.)

35. HISTIOCOTTUS Gill.

Peropus LAY and BENNETT, Beechey's Voy., Zool., Fish., 1839, p. 59 (*bilobus*); name preoccupied.
Histiocottus GILL, Proc. U. S. Nat. Mus., 1888, p. 573 (*bilobus*).

This genus is very close to *Blepsias*, from which it differs in the absence of smooth areas on the body; the fins are lower, the dorsal not emarginate, and the pectoral much larger, perhaps capable of being used for flight. North Pacific.
(ἱστίον, sail; *Cottus*.)

52. HISTIOCOTTUS BILOBUS (Cuvier and Valenciennes).

Blepsias bilobus CUVIER and VALENCIENNES, Hist. Nat. Poiss., IV, 1829, p. 379, Kamchatka (Coll. M. Collée, Brit. Mus.).—GÜNTHER, Cat., II, 1860, p. 153.—JORDAN and GILBERT, Synopsis, 1833, p. 720.
Peropus bilobus BENNETT, Beechey's Voy., Zool., Fish., 1839, p. 59.
Histiocottus bilobus JORDAN and GILBERT, Rept. U. S. Fur Seal Comm., III, p. 468.—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 2018; Kadiak.—SCHMIDT, Faune mer Japon, 1903, p. 15; Sea of Japan.

FIG. 39.—HISTIOCOTTUS BILOBUS.

D. IX–21; A. 18; P. 16. Body shorter and deeper than in *Blepsias cirrhosus*, with thicker caudal peduncle and heavier head, the bones less firm; snout short, obtuse, interorbital space very wide, concave, ½ wider than the small eye; short occipital ridges present, besides several bluntish tubercles. Mouth broad, oblique, the maxillary reaching pupil; teeth small, distant; barbels as in *cirrhosus*. Head and body covered with prickles, larger and blunter than in *cirrhosus;* no naked patches on body; fins less developed than in *cirrhosus;* first 5 or 6 spines of dorsal subequal, the last 3 abruptly shorter; pectorals longer and much broader than in *cirrhosus*, reaching seventh anal ray; caudal short, much shorter than head. Olivaceous, paler below; dorsal region with 4 or 5 black bars, reaching one-third the distance to the lateral line, and somewhat continued on the fins; caudal with a black

bar at base, otherwise plain; pectorals and anal blotched with black. Coast of Alaska and Kamchatka, not very common; the specimen here described from Kadiak; recorded by Schmidt from near Vladivostok.

(*bilobus*, two lobed.)

36. BLEPSIAS Cuvier.

Blepsias CUVIER, Règne Animal, 2d ed., 1829 (*cirrhosus*).

Head and body compressed; skin hispid with stiffish villiform prickles, and with definitely naked areas; snout and chin with several rather long barbels; mouth small; teeth villiform, on jaws, vomer, and palatines; preopercle with 2 short blunt spines; gill membranes free from the isthmus; gills 4, a slit behind the fourth; top of head with bony ridges; suborbital stay narrow; first dorsal short, elevated in front, emarginate, the spines slender; second dorsal large; anal similar, lower; ventrals very short, I, 3; pectorals long. North Pacific.

(An old name of some fish; from βλέπω, look.)

53. BLEPSIAS DRACISCUS Jordan and Starks, new species.

SACHIKO;[a] ISOBATENGU.

Head $3\frac{5}{6}$ in length without caudal; depth $3\frac{1}{2}$; dorsal IX (IV, I, IV)–24; anal 20; lateral line 50. Eye $4\frac{1}{4}$ in head; snout $4\frac{1}{2}$; maxillary $2\frac{1}{2}$; interorbital space 4; second dorsal spine $1\frac{1}{6}$; longest soft ray $1\frac{1}{4}$; longest anal ray $1\frac{2}{6}$; length of pectoral $\frac{3}{4}$; ventral $2\frac{2}{4}$; caudal 1.

Body much compressed. Mouth rather oblique. Anterior end of maxillary on a level with lower fourth of eye; posterior end reaching to below middle of eye. Rather narrow bands of villiform teeth on jaws, vomer, and palatines. Nasal spines well developed, at each side of the produced process from the premaxillary. Superorbital rim raised, making the wide interorbital space deeply concave. A pair of low ridges near middle of interorbital space, diverging posteriorly and each having a short flap opposite middle of eye. Parietal ridges strong, rather uneven, continuous with a ridge apparently on upper limb of posttemporal. A slight transverse ridge in front of parietal ridges bounding a quadrate pit. A ridge on side of head running backward from upper fourth of eye. Suborbitals with a slight ridge continuous on suborbital stay. Four prominent but blunt spines on edge of preopercle; the one next to the top the longest. Nostrils ending in a tube. A pair of long tentacles at tip of snout, and a single median one just above them; a similar tentacle on superorbital rim over posterior third of eye; 3 tentacles on each side of mandible; a short one near end of maxillary.

[a] *Sachiko* means child of the Sachi, the Agonoid fish *Draciscus sachi;* Isobatengu is "Nosey of the Surf." Tengu (Nosey) is a long-nosed comical being in Japanese mythology.

Body entirely hispid with small prickles, except an area on side of caudal peduncle (which does not extend anterior to base of last anal ray), and a subcircular area behind base of pectoral about the size of eye. Prickles more scattered on head; a few behind end of maxillary, some on cheek and opercle, a few on top and side of head behind eye, and some between mandibles. No naked area following lateral line. Fins naked.

Spinous dorsal divided into 3 portions and slightly connected to soft dorsal. The first 4 spines very high; the last one not decreased greatly in length; the membrane between them scarcely incised; the next portion a single spine; shorter than the spines on each side of it; the membrane deeply incised before and behind it; its upper half free; the third portion elevated in front but decreasing rapidly in height to its fourth spine, which is not as long as pupil. The longest dorsal rays behind the middle of the fin; the last 4 or 5 rays decreasing

FIG. 40.—BLEPSIAS DRACISCUS.

rapidly in length, so that their tips do not reach so far back as those anterior to them, which reach a little past base of caudal when depressed; last ray adnate to caudal peduncle for nearly its whole length. Anal similar to soft dorsal, but lower; its rays just reaching caudal; its last ray adnate for only half its length. Pectoral long and rounded posteriorly; its tip reaching to above base of fifth or sixth anal ray. Ventrals with 3 rays each; the middle ray the longest; barely reaching to vent. Caudal long and truncate; its angles rounded.

Color dark brown, growing lighter below; top of head and nape blackish; six irregular narrow black bars on back not reaching to lateral line; naked area under pectoral light, and a light area a little behind it; belly, throat, and chin pale; the tentacles on chin sometimes dusky. A dark vertical bar from eye to end of maxillary, and another from eye across cheek; cheek and opercle otherwise mottled with brown; spinous dorsal uniformly dusky; soft dorsal and anal irregu-

larly blotched with dusky, and with fine lines across the rays; caudal marbled, and with 2 or 3 very irregular crossbars. Pectoral dark and mottled; a large light area on its upper basal portion.

In life the color is blackish green or dusky red, according to the color of the seaweeds about it; silvery area white.

This species may be known from *Blepsias cirrhosus*, its representative farther northward and eastward, by its having no naked area following the lateral line, by the single naked spot behind pectoral, by the prominent tentacle on superorbital rim, and by the form of the spinous dorsal.

The specimens from Iturup Island in the Kuriles that have been referred to *Blepsias cirrhosus* belong to this species. Specimens were taken by Jordan and Snyder at Hakodate and Aomori.

The type is from Aomori; it is 19 cm. in length, and is numbered 7720, Ichthyological Collection, Leland Stanford Junior University Museum. Others, cotypes, are numbered 50929, U.S.N.M.

(*draciscus*, a high-finned Agonoid fish of Japan, of which *Blepsias* is fabled to be the child.)

37. NAUTISCUS Jordan and Evermann.

Nautiscus JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 2019 (*pribilovius*).

This genus is closely allied to *Nautichthys*, having the same gill structures and dentition, but the first dorsal is only moderately elevated, its height being less than depth of body. There are no cirri on the head, and there is no marked depression at the occiput, the base of the dorsal being little raised above the nape; preopercle with four obsolete spines.

54. NAUTISCUS PRIBILOVIUS (Jordan and Gilbert).

Nautichthys oculofasciatus GILBERT, Rept. U. S. Fish Comm. 1893, (1896), p. 434; not of Girard.

Nautichthys pribilovius JORDAN and GILBERT, Rept. U. S. Fur Seal Comm., III, p. 468, pl. LXIX, 1898; off St. George Island. (Type, No. 48237, U.S.N.M. Coll. Jordan.)—JORDAN and EVERMANN, Fish. N. and M. Amer., p. 2019; St. George, Bristol Bay, Alaska Peninsula.—SCHMIDT, Faune Mer. Japan, 1903, p. 16; Okotsk Sea.

D. VIII–23; A. 15.

Shape of head and body much as in *Nautichthys oculofasciatus;* head short, the snout rather sharp, the anterior profile steep; nasal spines prominent, a short occular cirrus, shorter than pupil; interobital space narrow, about one-half eye, deeply concave; a blunt triangular ridge above each orbit, with a deep cross furrow behind it which deepens to a pit at the vertex; nuchal ridges, each with a coarse tubercle, lower and larger than in the other species. From the nuchal depression, the

base of first dorsal spines rises much less abruptly. Preopercle with 4 blunt prominences, the upper often longer and more spine-like. Mouth nearly horizontal, the lower jaw included; a slender filament at end of maxillary; teeth small, a few on vomer and a narrow band on palatines. Gill membranes broadly united to isthmus, the gill opening extending a little below the lower edge of pectoral. Skin covered with close-set villous prickles, among which large ones are frequently seen arranged in rather definite longitudinal series, of which there may be 2 or 3 parallel with the back, and 1 running near lower line of tail. No smooth areas on sides. Lateral line conspicuous, the plates with short spines directed backward. Dorsals separate, the first not notched, comparatively low, the first spine highest, $1\frac{2}{3}$ in head in type; in other specimens $1\frac{1}{4}$ to $1\frac{1}{6}$ in head; soft dorsal and anal also low, none of the rays reaching base of caudal when depressed; pectoral longer than head; ventrals $1\frac{1}{2}$ to 2 in head. Color, dull light olivaceous, mottled

FIG. 41.—NAUTISCUS PRIBILOVIUS.

with darker; 3 or 4 dark bands below soft dorsal, 1 below spinous dorsal; a black band through eyes and across cheeks, extending onto branchiostegal membranes; 7 dusky spots along lateral line, a conspicuous pink blotch, rather larger than pupil, between first and second blotch; first dorsal dusky; second dorsal, anal, and pectoral dotted and checked; caudal with faint finely checked cross lines, which deepen to form a dark bar at its base and a broader one toward its tip; ventrals pale; belly mottled. Bering Sea, the type from St. George Island, one of the Pribilof Islands, in 23 fathoms; Unalaska, Bristol Bay, and south of the Alaskan Peninsula. Recorded from Aneiva Bay, Saghalin, by Dr. Schmidt.

(*pribilovius*, from the Pribilof Islands, named for their discoverer, Gerassim Pribilof, 1786.)

38. HEMITRIPTERUS Cuvier.

Hemitripterus CUVIER, Règne. Anim., 2d ed., II, 1829, p. 164 (*americanus*).

Body moderately elongate, scaleless, but the skin covered with prickles and bony protuberances of various sizes and forms. Head large, with numerous bony humps and ridges and fleshy slips above; orbital rim much elevated, the interorbital space deeply concave; a depressed area at the occiput, behind which are 2 blunt spines on each side. Mouth very wide; jaws, vomer, and palatines with broad bands of teeth; no slit behind last gill; gill membranes broadly united, free from isthmus; preopercle with stout, blunt spines; suborbital stay very strong, forming a sharp ridge. Spinous dorsal much longer than the soft part, of 16 to 18 spines, of which the first 2 are the highest, and the fourth and fifth shorter than the succeeding ones, the fin thus deeply emarginate; pectoral fins very broad, much procurrent; ventrals I, 3. Large fishes of singular appearance, inhabiting the North Atlantic and Pacific. Dr. Gill makes of them a distinct family on account of the great length of the spinous dorsal and the peculiar development of the myodome. The genus is, however, related to *Blepsias* and *Nautichthys*, and the spinous dorsal is as long in *Jordania* as in *Hemitripterus*, while the two genera stand as extremes in the Cottoid group.

(ἡμι—, half; τρεῖς, three; πτερόν, fin.)

55. HEMITRIPTERUS VILLOSUS (Pallas).

Cottus villosus PALLAS, Zoogr. Ross. Asiat., III, 1811, p. 129; Cape Kronok, Kamchatka; mouth of Itscha R. after MS. of Steller.—CUVIER and VALENCIENNES, Hist. Nat. Poiss., IV, 1829, p. 196 (copied).—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 2022 (copied).

Hemitripterus cavifrons LOCKINGTON, Proc. Ac. Nat. Sci. Phila., 1880, p. 233; Kadiak Island.—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 2023 (same specimen).

Head $2\frac{4}{5}$ in length to base of caudal; depth $4\frac{1}{4}$. Dorsal III, 14 or 15–13; anal 14; p. 20; scales 42. Eye (not orbital cavity) $6\frac{2}{3}$ in head; snout $4\frac{1}{6}$; maxillary $1\frac{2}{3}$; interorbital space 3.

Upper profile of head much broken up into bony tubercles; the orbital rim and premaxillary process strongly produced. Mouth large; the maxillary reaching to behind posterior margin of eye a distance equal to a diameter of pupil. Lower jaw blunt and projecting. Teeth sharp, conical, rather long, and slightly hooked backward. Interorbital space wide and deeply concave; a large triangular pit at its middle, the sides of which are a little convex. Two prominent ridges, and a short one between them, diverge outward on superorbital region from a point at posterior angle of interorbital pit. A quadrate pit at vertex; narrow behind; bounded on each side by a ridge which bears 3 blunt tubercles. A pair of blunt tubercles a short distance behind superor-

bital rim, and another on posttemporal in line with them, but a distance behind them nearly equal to diameter of eye. An uneven ridge along suborbitals which divides into 3 or 4 diverging ridges on cheek; these more conspicuous in large examples. A pair of short sharp ridges on preorbital diverge downward to edge of premaxillary. Four blunt spines on edge of preopercle; the upper one directed upward and backward, the next backward and a little downward; the next downward and a little forward, or in an opposite direction from the upper one; the lower one downward and forward. The lower one is only a slight round angle. The angular region of mandible is produced and prominent. Opercle with a prominent ridge. Nasal spines well developed and rather sharp. The premaxillary processes work in a deep cavity which is bounded around its posterior portion by a low sharp ridge curving from one nasal spine to the other. There are many tentacles about head, many of them multifid; 1 in front of nasal spine; 1 at each side of front of upper jaw above edge of premaxillary; 1 at each posterior corner of interorbital pit; 1 at pterotic region; 1 on cheek behind posterior end of suborbital ridge, and another on opercle in line with it; 1 near posterior end of maxillary, and a much smaller one at middle of maxillary; 1 at each side of front of lower lip; 4 along lower edge of each side of mandible.

Skin of body covered with small tubercles which feel rather harsh to the touch; those on back, especially anteriorly, larger and harder than elsewhere. Lateral line armed with small bony tubercles, many of which bear flaps at irregular intervals.

First three dorsal spines connected by a membrane which is not deeply incised. The first and second spines by far longer than any of the others, the second only slightly shorter than the first; the length of the first equal to post-orbital part of head. The fourth spine three-fourths as long as the third, which is contained $3\frac{1}{5}$ times in the head. The membrane of the second portion of the spinous dorsal is very deeply incised. Each spine with a long bifid tentacle at its tip. The longest soft dorsal rays a little longer than the longest spines in the portion of the fin. The tips of the last dorsal rays do not reach so far posteriorly as do those of the anal, which just reach to the base of the lower axillary caudal rays. Caudal slightly rounded in outline. Pectoral with 19 rays, the sixth or seventh from the top the longest; they fail to reach the first anal ray by a distance equal to the diameter of the eye; the rays below the longest are swollen. Ventrals 3 rayed; the middle ray the longest; not quite reaching to the vent.

Color grayish, mottled with large, irregular, dark spots, which are clear cut and are usually outlined with light gray; fins all mottled with dark brown or dark gray; in some of the smaller specimens the spinous dorsal is nearly black; mandible, maxillary, and sides of head finely mottled; belly and branchiostegal region white.

The following is a note of the colors of a fresh specimen: Dull olive, rather pale, belly still paler; dorsal and caudal dull crimson, with lighter and duller shades; chin speckled with white; no bright colors.

The above description is of a specimen 26 cm. in length from Hokodate. Other large specimens were obtained at Nemuro and Mororan. Some small specimens were dredged by the U. S. Fish Commission steamer *Albatross* off Kinkwazan Island, in Matsushima bay, stations 3770 and 3771.

This species is evidently the early described *Cottus villosus* of Pallas. *Hemitripterus cavifrons* of Lockington, from Kadiak, agrees in all respects noted by the author. This species is extremely close to its ally of the Atlantic coast shores of Canada and New England, *Hemitripterus americanus*. The head is perhaps a little rougher in the Japanese species. Dr. Schmidt regards it as identical with *H. americanus*.

(*villosus*, hairy.)

39. PSYCHROLUTES Günther.

Psychrolutes GÜNTHER, Cat., III, 1861, p. 516 (*paradoxus*.)

Body tadpole-shaped, tapering from the head to the very slender tail, covered with very loose, naked, movable skin. Head large, depressed, flattish above; snout obtuse, rounded; interocular space very broad, the ocular ridges obsolete; mouth very large; mandible short, little cavernous, its forms broadly U-shaped; maxillary entirely adnate to the skin of the preorbital; jaws with bands of villiform teeth; no teeth on vomer or palatines; no spines or cirri about the head; suborbital stay narrow. Gill membranes united to the isthmus; gills $3\frac{1}{2}$, no slit behind the fourth. Branchiostegals 7. Fins connected; spinous dorsal of short, slender, flexible spines entirely embedded in the skin and not visible without dissection as the spines do not rise above level of the muscles; soft dorsal short, high, the rays close together, the total number 12 to 24; anal low, of 9 rays; caudal separate; pectoral fins long, with a broad, procurrent base. Ventrals I, 3, close together, distinct, the inner edge adnate to the body. Small fishes, very closely allied to *Cottunculus* and *Malacocottus* on the one hand and to the *Liparididæ* on the other, their characters, like those of the latter family, arising from degeneration of the *Cottidæ*. The extension of the lax skin over the spinous dorsal and the bones of the head afford the only tangible diagnostic character of the subfamily *Psychrolutinæ*. From the *Liparididæ*, their separate ventrals distinguish them sufficiently. Small shore fishes of the North Pacific; only a single species known.

(ψυχρολούτης, one who bathes in cold water.)

56. PSYCHROLUTES PARADOXUS Günther.

Psychrolutes paradoxus GÜNTHER, Cat., III, 1861, p. 516; Gulf of Georgia, Vancouver Island (Coll. H. M. S. *Plumper*).—JORDAN and GILBERT, Synopsis Fish. N. Amer., 1883, p. 687.—JORDAN and GILBERT, Rept. U. S. Fur Seal Comm., III, 1898, p. 469; St. Paul Island, Iturup Island, Karluk.—JORDAN and EVERMANN, Fish. N. and M. Amer., II, 1898, p. 2026; Unalaska.

Psychrolutes zebra BEAN, Proc. U. S. Nat. Mus., 1890, p. 43; Aleutian Islands, between Unga and Nagai islands, at Albatross Station 2848, 55° 10′ N., 160° 18′ W., in 110 fathoms.—JORDAN and STARK, Proc. Cal. Ac. Sci., 1895, p. 811, pl. LXXXV.—GILBERT, Rept. U. S. Fish Comm., 1893 (1896), p. 410.

Head $3\frac{2}{3}$ in length; depth $4\frac{1}{2}$, equal to head without snout. D. IX, 15 to 17, only 12 rays seen without dissection; A. 12 or 13; V. I, 3; branchiostegals 7. Head large, very broad, tapering suddenly to caudle peduncle. Eye $4\frac{1}{4}$ in head, a little shorter than snout, a little less than width of interorbital space. Maxillary extending to below middle of eye. Interocular space flat, not concave; jaws equal, the

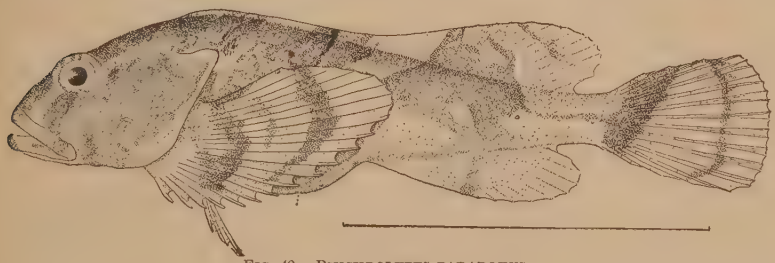

FIG. 42.—PSYCHROLUTES PARADOXUS.

lower ⌒-shaped, its arch not narrowed behind. Pectoral reaching to slightly above origin of anal, $2\frac{2}{3}$ in body; ventrals very small, one-third length head. Vent about midway between ventral and anal origin, the second dorsal beginning nearly over tip of pectoral; first dorsal entirely buried in the skin, its short, stiffish spines to be found only by dissection. Color light chocolate brown above, with minute spots of dark; whitish below; a pale stripe from eye downward and forward, between 2 dark ones; body with 3 very irregular dark cross bands, the third extending on dorsal and anal, the first 2 largely confluent and all very irregular in form; an oblique dark band on base of caudal, a narrow dark band behind it; pectoral with 2 or 3 cross bands; all fins, except the ventral, with traces of bands. Length $2\frac{1}{2}$ inches. A specimen, 50 mm. long, taken by the U. S. Fish Commission steamer *Albatross* off St. Paul Island, Bering Sea, in 1896, shows the following characters: Head $2\frac{3}{5}$; depth 3. D. IX, 15; A. 13; P. 19; eye 4 in head; width of mouth, from angle to angle, $1\frac{1}{2}$; snout $3\frac{1}{3}$; interorbital $3\frac{1}{5}$. Body short, broad, thick, tadpole-shape, the texture soft like that of a Liparid, especially about the head; the skin is limp and smooth, covered with little soft dermal warts, that of head especially lax, the

cheeks tumid and translucent. No trace of spines on head, the bones all thin and weak; nostrils each in a short tube; mouth broad, its cleft chiefly anterior, the jaws equal; teeth very minute, none on vomer or palatines; lower jaw with 8 large open pores. Gill membranes broadly united to the isthmus, the gill opening extending to slightly below base of pectoral. Lateral line obsolete. Dorsals united, with a slight notch between, the first buried in a ridge of skin so that its delicate spines can not be counted from without; second dorsal low, similar to anal, both of them free from the caudal; lower pectoral rays progressively shortened, the longest $1\frac{1}{5}$ in head; ventrals moderate, I, 3, reaching vent, $2\frac{1}{3}$ in head; caudal rounded. Color creamy white, with blackish cross bands, irregular in form and broken by whitish patches; 5 black spots on lower jaw; top of head blackish; a narrow blotch at shoulder; a wider one across first dorsal; a broad one on second dorsal abruptly broadened on body, then narrowed, extending across anal; an irregular bar at base of caudal; a narrow bar and some spots and streaks on the fin; pectoral with 2 curved bars, the inner concave, the outer convex backward, the two inclosing a rounded pinkish or deep orange area. (Jordan and Gilbert.) Alaska to Puget Sound, rather common in water of moderate depth; a remarkable little fish, evidently a degraded Cottoid. Here described from specimens from Unalaska. This species is taken abundantly in shallow water about Kadiak, south of the Alaskan Peninsula, thence westward through Unimak Pass, along the northern shore of Unalaska Island to Iturup Island, and the Pribilof Islands and in Bristol Bay. The depths range from 38 to 121 fathoms. It has been also dredged by Dr. Schmidt off Cape Pestschuzoff, coast of Korea.

(*παράδοξος*, unaccountable.)

40. EREUNIAS Jordan and Snyder.

Ereunias JORDAN and SNYDER, Proc. Cal. Ac. Sci., (3d ser.), II, 1901, p. 377 (*grallator*).

Body moderately elongate, tapering into a long and slender tail, the nuchal region elevated. Head large, not compressed or depressed. Eye very large. Preorbital broad. Mouth horizontal, lower jaw included, maxillary extending a little beyond anterior margin of pupil. Teeth in villiform bands on jaws, vomer, and palatines. Gill openings wide, the gill membranes broadly united, free from the isthmus. Gill rakers short, club-shaped; a small oval slit behind last gill arch. Suborbital stay distinct, covered by the rough skin. Nasal spines present; a stout spine before eye; a much larger one on upper rim of orbit; a divided spine at nape; 2 small ones on lower margin of preorbital; a large hooked spine at angle of preopercle; 2 smaller sharp spines below the latter; a blunt spine on upper edge of opercle. Skin close set with velvety prickles. Lateral line distinct,

armed with spines which are strong and curved anteriorly. Sides with 2 series of stout curved spines, besides 3 series of smaller ones. Dorsal fins separate, of moderate height, with 10 slender spines; rays, 1, 12. Anal low, of 12 rays, opposite soft dorsal. Caudal small, truncate. Pectoral short, of 11 united rays, below which are 4 simple, free ones, similar to those of *Prionotus* and *Trigla*. Ventrals entirely wanting.

The relations of the genus are at once with Cottidæ and Triglidæ. We place it provisionally as a subfamily, Ereuniinæ, Cottidæ. It is not unlikely that the absence of ventrals and the singular form of the pectoral will demand for it a distinct family.

(ἐρευνάω; to explore.)

57. EREUNIAS GRALLATOR Jordan and Snyder.

Ereunias grallator JORDAN and SNYDER, Proc. Cal. Ac. Sci., (3d ser.), II, 1901, p. 378; Misaki.

Head, measured to end of opercular flap, $2\frac{2}{3}$ in length; depth $4\frac{3}{4}$; eye $3\frac{1}{8}$ in head; maxillary $2\frac{1}{2}$. D. X, I–12; A. 12; P. 11 + 4; lateral line 42. Length of type 305 mm.

FIG. 43.—EREUNIAS GRALLATOR.

Body moderately elongate, tapering into a long, slender, quadrate, caudal peduncle, the length of which is contained $1\frac{1}{2}$ times in the head, its depth 6 in its length. Vent slightly in front of middle of body. Eye very large, placed high, its upper margin projecting above outline of head, its diameter about equal to length of snout, its upper part covered with rough skin. Mouth horizontal, the lower jaw included, the maxillary reaching slightly beyond line of front of pupil. Teeth villiform on jaws, vomer, and palatines; those on palatines in a long narrow band. Gill openings broadly united over the isthmus; a small oval slit behind last arch. Gill rakers short, club-shaped, about 3 + 11 on first arch. Pseudobranchiæ large, of long filaments. Branchiostegals 6. Suborbital stay short, triangular.

Head and body covered with a velvety shagreen. Nasal spines short and sharp; upper rim of orbit with spines, the posterior of which is large and strong, its length contained about $4\frac{1}{2}$ times in eye; side of

nape with a large double spine; some small spines on temporal region; opercular spine obscure; preopercle above with a curved spine, the length of which is contained about 6 times in eye; 2 sharp spines below the latter, the upper of which is the longer; 2 small spines on lower edge of preorbital. Maxillary rugose, without barbels. Sides of body with rows of slender hooked spines, the uppermost row extending from nape to tail; the second row of smaller spines along lateral line; the third, below the curved part of lateral line, coalescent with it on the straight part; the fourth row of strong spines, beginning above vent and extending to base of caudal; a few spines below this, constituting a fifth row along base of anal. Lower edge of caudal peduncle with a long groove.

First dorsal low, of slender spines, the longest about 3 times in head. Dorsals separate, but close together, the longest soft ray $1\frac{2}{5}$ in head. Anal similar, its longest ray $3\frac{3}{5}$ in head. Caudal fin short, truncate, $2\frac{1}{2}$ in head. Pectoral fin of two parts; the upper of 11 rays, mostly branched, the longest ray $1\frac{3}{4}$ in head; lower part of fin of 4 separate, simple rays similar to the free appendages in Triglidæ; the uppermost longest, $1\frac{1}{3}$ in head; the lowermost shorter, $2\frac{1}{6}$ in head.

Color blackish, lining membranes of body dusky. Dorsals black, with a broad, whitish median band which disappears posteriorly on the spinous dorsal and anteriorly on the soft dorsal; membrane posterior to last dorsal spine white. Anal black, with a broad, white, longitudinal band near its base. Caudal dusky at base, broadly suffused with blackish posteriorly, middle part whitish. Pectoral dusky, the upper anterior part whitish, blotched with black; free rays black.

Of this very remarkable fish two specimens are known; they were taken in the Kuro Shiwo, or Black Current, at a depth of 290 fathoms off the coast of Misaki, Sagami Province, Japan, by Prof. Kakichi Mitsukuri. One of these specimens is in the Imperial University of Tokyo, the other was presented by Professor Mitsukuri to Leland Stanford Junior University, where it is registered as Type No. 6432.

The specimen in the Imperial Museum has, according to our notes, a conspicuous barbel at the tip of the maxillary. No trace of such a barbel is to be found on the type.

(*grallator*, one who walks on stilts.)

SUMMARY.

Family Cottidæ.

1. *Stlengis* Jordan and Starks.

1. *osensis* Jordan and Starks; Suruga Bay.

2. *Schmidtia* Jordan and Starks.

2. *misakia* Jordan and Starks; Sagami Bay.

3. *Archistes* Jordan and Gilbert.

3. *plumarius* Jordan and Gilbert; Ushishir Island.

4. *Daruma* Jordan and Starks.

4. *sagamia* Jordan and Starks; Sagami Bay, Owari Bay, Totomi Bay.

5. *Ricuzenius* Jordan and Starks.

5. *pinetorum* Jordan and Starks; Matsushima Bay.

6. *Artediellus* Jordan.

6. *pacificus* Gilbert.

7. *Icelus* Krøyer.

7. *spiniger* Gilbert.

8. *Stelgistrum* Jordan and Gilbert.

8. *stejnegeri* Jordan and Gilbert; Robben Island, Peter the Great Bay.

9. *Triglops* Reinhardt.

9. *beani* Gilbert; Robben Island.

10. *Prionistius* (Bean).

10. *jordani* Schmidt; Peter the Great Bay (Vladivostok).

11. *Hemilepidotus* Cuvier.

11. *gilberti* Jordan and Starks; Hakodate.

12. *Enophrys* Swainson.

12. *claviger* (Cuvier and Valenciennes); Robben Island.

13. *Ceratocottus* Gill.

13. *diceraus* (Pallas); Robben Island.
14. *namiyei* Jordan and Starks; Nemuro, Soya.

14. *Trachidermus* Heckel.

15. *ansatus* (Richardson); Chikugo R.

15. *Cottus* Linnæus.

16. *kazika* Jordan and Starks; Niigata.
17. *pollux* Günther; Tana R., Semida R., Kitakami R., Kami R., Niigata, Aomori, Kamashiro.

16. *Uranidea* De Kay.

18. *reinii* (Hilgendorf).
19. *dybowskii* (Hilgendorf).

17. *Rheopresbe* Jordan and Starks.

20. *fujiyamæ* Jordan and Starks; Odawara.

18. *Myoxocephalus* Steller.

21. *polyacanthocephalus* (Pallas); Robben Island.
22. *jaok* (Cuvier and Valenciennes); Robben Island.
23. *edomius* Jordan and Starks; Mororan, Hakodate.

24. *nivosus* (Herzenstein); Same, Mororan, Hakodate, Iturup.
25. *raninus* Jordan and Starks; Aomori, Mororan, Hakodate.
26. *stelleri* Tilesius.
27. *brandti* (Steindachner).

19. *Megalocottus* Gill.

28. *platycephalus* (Pallas).

20. *Ainocottus* Jordan and Starks.

29. *ensiger* Jordan and Starks; Hakodate.

21. *Porocottus* Gill.

30. *tentaculatus* (Kner).

22. *Argyrocottus* Herzenstein.

31. *zanderi* Herzenstein; Iturup Island.

23. *Zesticelus* Jordan and Evermann.

32. *bathybius* (Günther); off Misaki.

24. *Cottunculus* Collett.

33. *brephocephalus* Jordan and Starks; Suruga Bay.

25. *Gymnocanthus* Swainson.

34. *pistilliger* (Pallas); Robben Island.
35. *intermedius* (Schlegel); Hakodate; Same, Otaru.
36. *herzensteini* Jordan and Starks; Hakodate.

26. *Crossias* Jordan and Starks.

37. *allisi* Jordan and Starks; Hakodate, Same.

27. *Cottiusculus* Schmidt.

38. *gonez* Schmidt; Peter the Great Bay.
39. *schmidti* Jordan and Starks; Matsushima Bay.

28. *Elaphichthys* Jordan and Starks.

40. *elongatus* (Steindachner).

29. *Alcichthys* Jordan and Starks.

41. *alcicornis* (Herzenstein); Same, Hakodate.

30. *Furcina* Jordan and Starks.

42. *ishikawæ* Jordan and Starks; Myiako, Wakanoura, Hakodate.
43. *osimæ* Jordan and Starks; Hakodate, Misaki.

31. *Ocynectes* Jordan and Starks.

44. *maschalis* Jordan and Starks; Enoshima, Wakanoura.

32. *Pseudoblennius* Schlegel.

45. *percoides* Günther; Tokyo, Matsushima, Misaki, Wakanoura, Tsuruga, Hiroshima, Nagasaki.

46. *cottoides* (Richardson); Misaki, Matsushima, Onomichi, Aomori, Enoshima, Tokyo, Yokohama; Tsuruga, Hakodate.
47. *zonostigma* Jordan and Starks; Misaki, Nagasaki.
48. *marmoratus* (Döderlein); Misaki, Enoshima.
49. *totomius* Jordan and Starks; Totomi Bay.

33. *Bero* Jordan and Starks.

50. *elegans* (Steindachner); Tokyo, Aomori, Kitami, Hakodate.

34. *Vellitor* Jordan and Starks.

51. *centropomus* (Richardson); Misaki, Tokyo.

35. *Histiocottus* Gill.

52. *bilobus* (Cuvier and Valenciennes).

36. *Blepsias* Cuvier.

53. *draciscus* Jordan and Starks; Aomori, Hakodate, Iturup Island.

37. *Nautiscus* Jordan and Evermann.

54. *pribilovius* (Jordan and Gilbert).

38. *Hemitripterus* Cuvier.

55. *villosus* (Pallas); Hakodate; Mororan, Nemuro, Matsushima Bay.

39. *Psychrolutes* Günther.

56. *paradoxus* Günther.

40. *Ereunias* Jordan and Snyder.

57. *grallator* Jordan and Snyder; Misaki.